THE CP/M USER'S JOURNAL

A. Miller

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Microsystems

Volume 4 / Number 12

December 1983

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CP/M Software Directory

More than 1700 programs from nearly 500 vendors, classified by application.

Software Reviews

William Wong reviews three more CP/M implementations of LISP, including one that features object-oriented structures.

Robert Stek reviews APCBASIC. This can run North Star Basic programs but has important extensions that make some operations easier to design and code.

Hardware Reviews

Need to program many different types of PROMs? The Microdynamics S-100 EPROM Programmer, reviewed by Ian Darwin, may be the solution to your problem.

Teach your computer to talk! Dennis Thovson shows you how the Ackerman Digital Synthetalker can give your computer a voice.

Inexpensive and versatile 16K and 32K memory boards from Digital Research Computers, reviewed by Mark Pickerill.

Other Feature Articles

Lawrence Azlin makes the debugging of C programs easier with a technique for embedding print statements in a single subroutine called from key points.

Ted Carnevale puts CP/M's IOBYTE function to work in the North Star, allowing the use of multiple printers and consoles.

Bring out those old MITS dynamic memory boards mouldering in the closet! Bill Kibler's simple modifications can give you 64K for no more than $60.

The Japanese gotcha! Ken Piggott tells a sad story of floppy disk hardware incompatibilities.

Bob Lurie shows how to get around a weakness in CBasic's implementation of trig functions.

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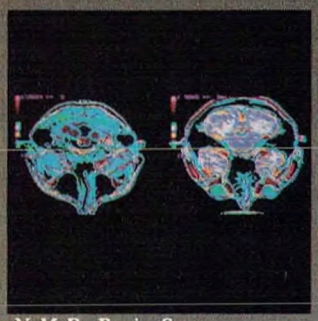

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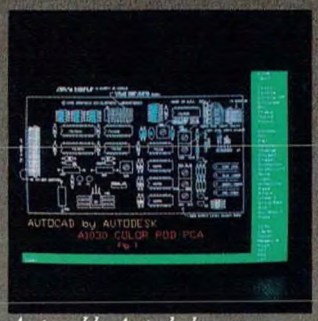

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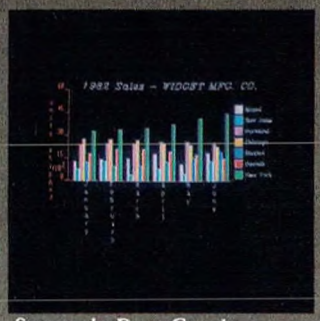

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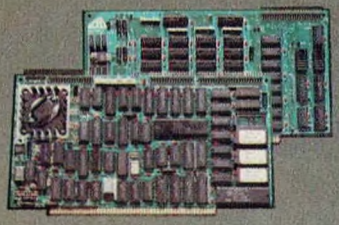

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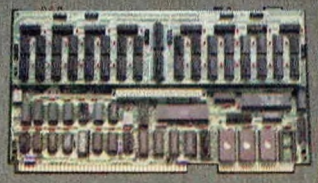

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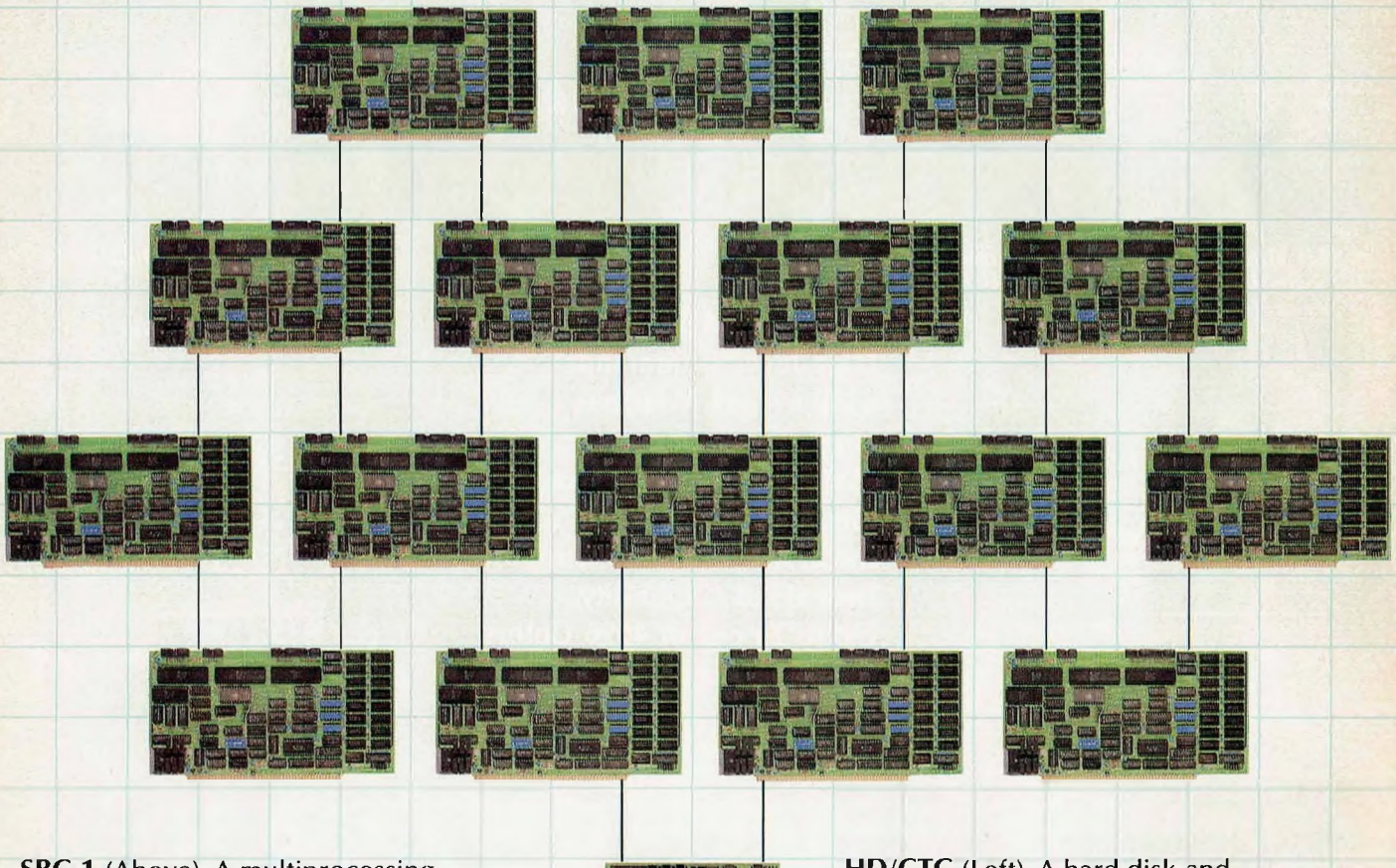

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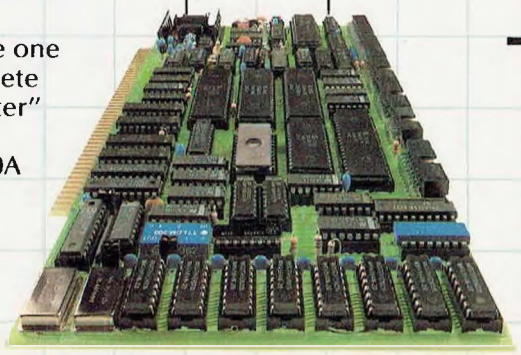

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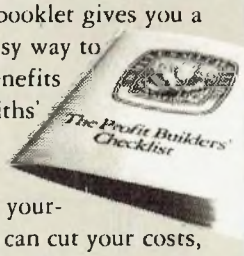

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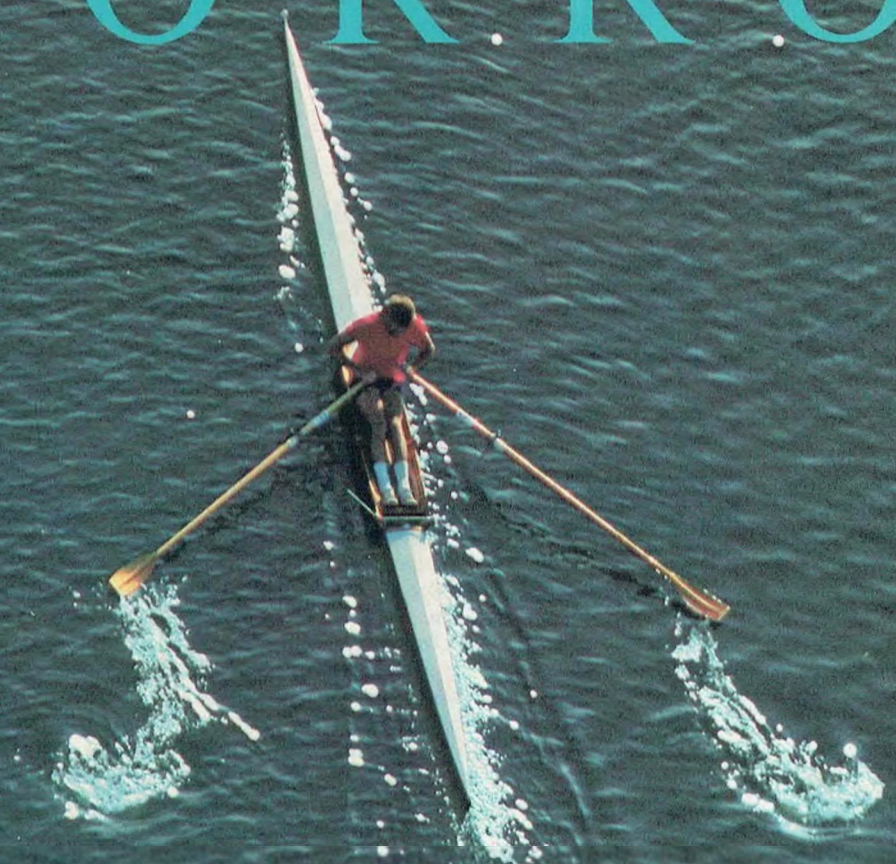

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CIRCLE 183 ON READER SERVICE CARD

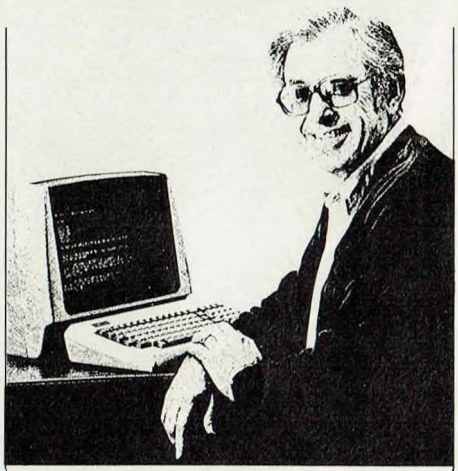
Editor's Page

by Sol Libes

It seems like ages, but it was only four years ago that I decided to publish *Microsystems.* Back then in '79, I had, for many years, been a computer hobbyist intrigued by these intelligent machines. It had become apparent to me that there was a significant void in the microcomputer magazine field. There were magazines catering exclusively to TRS-80, Apple, Pet, Heath, and other system users, and broad-based publications such as *Byte* and *Creative Computing.* The result was that S-100 system and CP/M users received only very minimal magazine coverage. There was a crying need for a publication to cater to us S-100 and CP/M users. After all, at the time S-100 and CP/M were by far the most popular bus-oriented microcomputer systems around. It was thus in the later part of 1979 that the idea of starting a magazine for this special interest group started to take shape in my mind.

I approached several magazine publishers with the idea and tried to convince them to start such a magazine. Their response amounted to a big fat zero. Basically, they felt that the circulation of such a publication would not be large enough to be financially worthwhile. One publisher told me that the S-100 bus was dead—a thing of the past. Another explained the magazine publishing business to me. . . that it would take at least three years to make it profitable. . . if I were lucky.

But the idea would not let go of me, and I began to think of publishing it myself. It would be the only



way a CP/M and S-100 magazine would ever come into existence.

I had had some experience as a writer and publisher. For four years I had produced a monthly newsletter for the Amateur Computer Group of New Jersey. It was typically about 16 pages and a lot of fun to put out. After all, I didn't get paid for the effort, so it had to be a labor of love. Further, I had written about 13 books and over a hundred magazine articles. So I felt confident that I knew how to grind out copy and put together a bimonthly publication.

I was lucky in several other respects. I had a wife and two kids (both were in graduate school at the time) to help me and a big basement to work in. Then there were two people who offered to help finance the effort with no questions asked. When Bill Godbout heard of what I was going to do, he sent me a check for a whole year's advertising paid in advance, and convinced his friend George Morrow to do the same. They, in effect, provided my original working capital.

And I was lucky in another respect. I had several friends who pitched in to help me. There were Russell Gorr and Glenn Dusch, who helped me with production. There was Bob Stewart, who was instrumental in getting the IEEE to allow me to publish the IEEE-696/S-100 standard. And there were Jake Epstein, Jon Bondy, Chris Terry, Larry Stein, Bill Yarnall and others who contributed articles without asking for payment (although they got paid later).

Thus it was in January of 1980 that the first issue of *Microsystems* rolled off the presses. I had 2,000 copies printed, and within a month I had to order another 3,000 copies. In July of that year we printed another 4,000 copies to fill back orders. That first copy became a collector's item, with the last thousand copies going for $5 a copy (the original cover price was $2).

By the end of the first six months, circulation was already up to 5,000. We were working seven days a week for ridiculously long hours. It became apparent that this had become a full-time business and I had to make a decision. . . whether to quit my job, hire a staff and divorce my wife. . . or. . . sell the magazine. I decided on the latter. I loved my family and my job, and the price of becoming a big businessman was just too high.

Fortunately Dave Ahl, the publisher of *Creative Computing*, was

Left to right: Hank Kee, Lennie Libes, Sol Libes, and Bruce Ratoff at a breakfast for* Microsystems *authors and RCPM Sysops, held during CP/M-83 East.

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Editor's Page
continued. . .

looking to increase his business empire, so I agreed to sell the magazine to him and remain as editor for three years. In January of 1982, Ziff-Davis bought Ahl Computing, which by then included four magazines, and I continued with the new company as editor of *Microsystems.*

The first issue of *Microsystems,* in 1980, had a grand total of 62 pages, including the front and back cover, and the magazine was published every other month. In January of 1983 *Microsystems* went monthly, and the number of pages has increased substantially to 168. Furthermore, circulation and advertising have also increased at a strong and healthy rate. Circulation is now 75,000. Who would ever have imagined that a magazine catering to very sophisticated and advanced users of microcomputers would become so successful?

After being the editor of *Microsystems* for four years, I have decided to retire. It has been a terrific time for me. I learned an awful lot and developed many warm relationships with some wonderful people. Although a large part of me went into the magazine, most of what is here is the work of many other individuals. . . Chris Terry, Bill Machrone, Dave Hardy, Ian Darwin, Anthony Skjellum, Bill Wong, Andy Bender. . . to mention just a few.

I will be continuing with *Microsystems,* but in a consulting capacity. My name will continue to appear on the staff page with the title "Editorial Director & Founder." However, I will no longer be involved in the issue-to-issue production of the magazine. I will continue to write the monthly "News & Views" column, an occasional article, and sort of "breathe down the back" of the editor a little.

For those who are interested in my other activities, I will still continue my participation in and work with the Amateur Computer Group of New Jersey (I produce their monthly newsletter) and SIG/M (I produce their infrequent catalogs). I will also continue to write the News and Views columns that appear in *Computers and Electronics* magazine and the *PC Technical Journal.* And lastly I hope to have more time to devote to my family and to my primary job as a professor of electronics at Union County College.

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News and Views

by Sol Libes

Random rumors & gossip

Microsoft is expected to shortly release MSBasic for 68000 machines to run under Xenix. The question is: will they put out a CP/M-68K version? What do you think?... There is a rumor that Morrow Designs may support the low-cost Nat NET local area network recently announced by Kaypro. NEC is also rumored to be considering doing the same for its APC machine... and last, there is a rumor that Digital Research is working on a version of CP/M-86 that will run MS-DOS software.

According to John Rowley, President of Digital Research, a large-scale IC will soon be available that integrates the Z80 processor and CP/M operating system, and it will be second-sourced in both Europe and Japan.

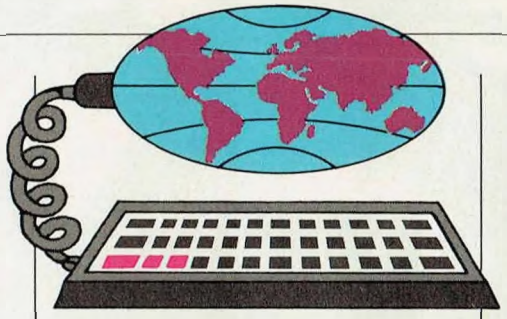
John Rowley predicts that this will move the installed base of CP/M from the current 1.5 million to over 5 million within the next 24 months. He further predicts that video disk technology will be widely available for home computers within the next two years and will radically change the fundamental nature of home computers. Rowley also predicts that Coleco and IBM will each distribute over a million home computers next year, and that by the end of next year Commodore will have sold over 2 million C64 machines.

DEC announces a micro-based VAX

Ken Olsen, president of DEC, recently disclosed that next year DEC will ship three new VAX machines, all using microprocessors. Formal introduction is scheduled for June, with shipments to customers by year-end. The VAX-1, scheduled for shipment first, will be implemented on four chips and have the performance of the current VAX 11/730. This will be followed by a VAX based on a single chip, and another version which includes a floating point processor.

The 32-bit micro race

For over a year now, AT&T and H-P have been in production on their 32-bit microprocessors, which are being used only within the companies.



NCR began sampling its 32-bitter last July, and National is promising samples of its 16032 this month. This will be followed next year by 32-bit samples from Intel, Motorola, and Zilog. With the exception of the NCR device, all are rated to have the power of a VAX and maintain some level of object-code compatibility with their 16-bit predecessors.

There is a rumor that IBM ordered 1,000 samples of the 16032 from National for evaluation. For most companies that is a production order. However, the likelihood is that IBM will use the 80386 from Intel in any desktop 32-bit machines, and the 16032 for minicomputer replacements.

There is no doubt that within another 3 to 5 years, we should have the power of a VAX at work on our desks.

Hard times in the desktop marketplace

Prices of home computer systems such as the Commodore, Atari, TI and Sinclair/Timex units appear to have stabilized and, to a limited degree, have even risen as we begin moving into the Christmas gift-buying season.

However, price competition and business losses that previously characterized only the home computer market have begun to appear in the desktop market, where systems are purchased by small businesses and professionals working at home.

As reported last month, Osborne Computer, the company that started the portable market and innovated by including several software packages with the system, has fallen on hard times. In mid-September, it found itself $5 million in the hole and was forced to lay off all but 80 of its workers (at its peak, the company employed 1,000 people). Suits by several debtors forced OC to file for protection under the bankruptcy law while it searched for additional funding to continue in operation. The word is that even in 1982, when Osborne did about $100 million, it failed to show a profit. And when competition heated up in '83 and OC was late in delivering its promised new Executive computer and IBM PC compatible option, their income nose-dived.

But Osborne is not alone in having problems selling desktop units. Earlier this year Archives Inc. closed its doors, and Xerox has reportedly never shown a profit on the Model 820 that it has been selling for three years now. And it is a similar tale for Victor Technologies, Vector Graphic, Computer Devices, Intertech Data Systems, and Fortune Systems.

It has been estimated that there are now almost 200 companies competing for the desktop market, creating an oversupply and the resulting price competition. The companies in trouble are those which have made the worst mistakes. Even companies like Digital Equipment Corporation and Hewlett-Packard are rumored to be showing red ink in the personal computer divisions. And there are rumors that sales of the Apple Lisa are significantly less than expected, causing Apple to reduce its price in an attempt to stimulate sales.

IBM, with its PC, has come to assume the dominant position in the desktop marketplace. Thus any company making a computer incapable of running IBM PC software is finding itself under pressure.

Several companies claim IBM PC compatibility because they employ the same microprocessor (the 8088), and run the MS-DOS operating system. However, users and dealers have discovered that these systems have differences (e.g., disk formats, display differences, different ROM calls, etc.) that prevent them from running some IBM PC software. The Compaq and Chameleon computers, which have a high degree of compatibility, are doing well; systems such as the Victor 9000 and TI Professional, which have much lower levels of compatibility, are doing poorly.

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Task	SUPER Time	dBASE II Time
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Totals	1:02:30 hrs.	13:50:08 hrs.

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News & Views
continued . . .

DRI announces personal CP/M on a chip

Watch out, Microsoft! Digital Research has formed a "Consumer Products Division" that has already announced two OEM products. The first is a ROM version of CP/M for low-cost home computers; this is menu-driven with help screens and prompt lines.

The second is the "Visual Information Processor," a set of I/O routines to give window facilities and mouse cursor control to low-cost machines. It is rumored that this software is being considered by Commodore for a system now in development. The system would provide a Lisa-like interface using standard ASCII characters instead of icons. Thus, a menu appears along the right-hand side of the screen, with prompt boxes along the bottom and a large working window above.

Also, DRI has appointed Ken Harkness, formerly president of Atari's Arcade Division, as the manager of the new Consumer Products Division. Previously, Harkness was with General Foods and Pepsico.

User group news

Some new user groups have come into existence. They are:

- **CPRO Users Group**—devoted to supporting CompuPro (Godbout) products. Membership is $10/yr. The group plans a newsletter containing technical information, bugs/fixes, etc., and group purchases. Write: **CPRO U.G.,** *Box 1479, Woodbridge VA 22192.*
- **S.U.G./U.S.A.**—devoted to supporting the Sanyo systems, will publish a newsletter and distribute public domain software. Write: **S.U.G./U.S.A.,** *Box 8069, Boston MA 02114.*
- **CP-PLUG**—devoted to supporting CP/M Plus, mainly on Apple, but on other systems as well. They will publish a quarterly newsletter and distribute public domain software. Membership is $5/yr, which includes newsletter and access to software library. Write: **CP-PLUG,** *c/o James M. Scardelis, Box 295, Little Falls NJ 07424; (201) 256-7249;* on Compuserve write 75665,436 (member of both MAUG and CP-MIG), or on Source write STT190.
- **CP/M SIG** (Central Florida Computer Society)—This group, which has been in existence for some time,

holds meetings on the 3rd Wednesday of each month at Florida Federal, 919 W. Hwy., Orlando. For information, call Tom White (305) 851-3243 or write: **CFCS,** *Box 8019, Maitland FL 32751.*

The top software suppliers

Software News each year reports on the "Top Fifty Software Vendors." This year seven microcomputer software vendors made the list, up from three last year. Furthermore, four of the software vendors who previously sold only mainframe software have also decided to get into the micro business as well. The micro software companies, their rank on the list, and sales (in thousands) for 1982 are:

9	MicroPro Intl. Corp.	$39,120
13	VisiCorp	35,000
14	Softsel Computer Products Inc.	34,485
22	Digital Research Inc.	22,032
23	Microsoft Corp.	22,000
37	Lifeboat Associates	15,000
44	Ashton-Tate	12,000

The mainframe software suppliers who are now into micro software are:

1	Management Science American	$101,244
2	Cullinet Software	69,691
4	Informatics General Corp.	68,034
26	Information Builders Inc.	19,200

MSA entered the micro business by acquiring Peachtree Software. Cullinet is selling software to IBM PC owners to allow them to use Cullinet software on mainframes. Informatics has entered into a joint agreement with VisiCorp to develop software that will allow machines using VisiOn to communicate with mainframes. Information Builders has announced that it is converting its DBMS software to run on the IBM PC.

I should think that readers of this column need no introduction to Micropro, Digital Research, and Microsoft. Softsel is the largest independent distributor of micro software selling mainly to retail outlets. Lifeboat is the largest independent distributor of CP/M-based software. Ashton-Tate produces the dBASE II and DBMS packages, as well as several others.

The WARGAMES computer

By now I would imagine that every micro hacker has seen the movie, "WARGAMES" with its NORAD supercomputer called "WOPR" (pronounced whopper), and the command control center that contained a dozen large overhead display screens and 52 terminals. And then there was the teenage computer wizard with his old IMSAI, who cracked the system to play a thermonuclear war game that turned out not to be a game.

Now we learn that everything was done on a microcomputer. Steve Grumette of the Artrifical Intelligence Research Group was responsible for the whole thing. The system used was a CompuPro 8/16 System with 1 MB of memory. The terminals were actually displays controlled by a CompuPro video card with a reprogrammed character set to display graphics. Screen images were created and saved on disk, then

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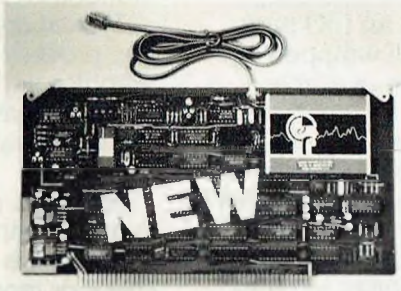

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MAGIC/L is easy to learn. It has syntax similar to C and Pascal, and because it's extensible as well as interactive, it dramatically increases productivity.

Program development features include a built-in text editor, command line recall, CCP, STAT, and PIP command emulation, and the ability to store keyboard dialog on disks.

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recalled onto the terminals. Programs were written so that when an actor hit the correct number of keys (any of them) the computer responded with a preprogrammed message. The overhead screens were created by computer-controlled projectors.

Moving from one OS to another

The problem of moving software from one operating system to another has been made easier by the introduction of software to do the translation. Some of these packages have been mentioned in this column previously, and some are currently under test by *Microsystems* reviewers. I thought I would mention the ones I am aware of (if readers know of others, please let me know):

Name/Vendor	Description
The Bridge **Unisoft Systems** *Berkeley CA* *(415) 644-1230*	CP/M ⟷ UniPlus+
OS Converter **Dynamic Microprocessor Assoc.** *New York NY* *(212) 687-7115*	CP/M ⟷ MS-DOS
Getfile **Professional Data Systems** *San Diego CA* *(619) 291-2300*	CP/M ⟷ MS-DOS
Module 8/16 **Professional Data Systems** *San Diego CA* *(619) 291-2300*	8080/Z80 ⟶ 8086
XLT-86 **Digital Research** *Pacific Grove CA* *(408) 649-3896*	8080/Z80 ⟶ 8086
MTRANS **Phase One Systems** *Oakland CA* *(415) 562-8085*	MBasic ⟶ Oasis

Random news bits

Microsoft, in an effort to promote its products with independent software suppliers, has dropped its runtime royalty fees for users of MBasic, Business Basic, and its Cobol compiler . . . IBM has decided to drop its 4" drive, citing lack of acceptance by OEMs—which probably means that the IBM PC division didn't want it.

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CIRCLE 167 ON READER SERVICE CARD

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CIRCLE 226 ON READER SERVICE CARD

In the Public Domain

by Chris Terry

In the early days of CP/M, when double density was the exception rather than the rule, programs tended to be compact, and disk space was seldom a problem. Double density and double-sided drives have vastly expanded the real estate available, and yet many floppy disk users are quickly running out of *Lebensraum.*

There are several reasons for this. Compiled programs with runtime libraries are inherently larger than tightly coded, assembly language counterparts. Software vendors, responding to the demands of nontechnical users, are including prompts and friendly messages with gay abandon, and disk-hungry database managers generate a multiplicity of small files. There are more than 200 volumes of public domain programs, many of which one wants to keep online—and text files eat space at an even more frightening rate than do programs.

What to do? Get a hard disk? Maybe, but without ruthless pruning and archiving, you can fill 20 MB almost as quickly as 2 MB. Fortunately, there is at least a partial solution: data compression.

Data compression

There are many techniques for compression. One possibility is recurrence coding, in which a string such as AB*bbbbbb*CD (10 bytes, where *b* is a space) might be encoded as AB*6CD (6 bytes, where *6 represents the six spaces). This would give good compression of columnar data using spaces instead of tab codes, but very little in straightforward text.

Another possibility would be pattern substitution based upon the frequency of various letters, using short patterns for frequent letters and longer patterns for the rare ones. The prime example of this is the International Morse code, in which the letter E (avg. 13%) is a single dot and J ((avg. 0.13%) is a dot followed by three dashes (a dash being three times as long as a dot). In 1952, D.A. Huffman published an article on the construction of such "minimum redundancy" codes. Use of Huffman codes can yield text compression varying from 75% down to as little as 40%, depending on the type of data being compressed. There are two public domain programs for file

compression, both of which use Huffman codes.

COMP2 and **EXP2**, in SIG/M Vol. 40, are compression/expansion programs based on those published in Harold Corbin's "Introduction to Data Compression" (*Byte,* April 1981) and were adapted for CP/M by Kelly Smith. I have not used these, and I suspect that they are for demonstration only, since the documentation states that " . . . processing of the input stream continues until a period (.) is detected, when control returns to CP/M." This, if literally true, would make compression of continuous text impossible.

SQUEEZE, UNSQUEEZE are more sophisticated programs written in C by Richard Greenlaw and upgraded by various other benefactors. .COM files are supplied and are ready to run on most systems. The C source code is available, and can be modified with an editor and recompiled with the BDS C compiler.

SQUEEZE first compresses repetitive characters, then constructs a Huffman code that is optimized for the data being compressed. The table of codes is incorporated into the squeezed file for use by UNSQUEEZE. Considerably greater compression is obtained by these techniques; a fixed Huffman code optimized for mixed upper/lower case text would be inefficient for an all-upper-case assembly source file. However, the inclusion of the table in the squeezed file may actually *lengthen* the output if **SQUEEZE** is used on a short file.

UNSQUEEZE has facilities for displaying the first N lines of a squeezed file on the console. Both SQUEEZE and UNSQUEEZE have I/O redirection via pipes, and another program (FLS) allows full use of this capability in combination with a command file.

TYPSQ is a version of UNSQUEEZE that allows an operator to display the unsqueezed version of a squeezed file without actually creating an unsqueezed disk file.

The latest versions I have found are SQ-16 and USQ-19 in Vol. 85 of the CPMUG library. These were obtained from the Hyde Park (Chicago) RCPM systems run by Ben Bronson. The previous version (SQ-15) is available on SIG/M Vol 60.

Partly to conserve space and partly to reduce the transmission time required for large files, most RCPM systems store their .ASM form. You therefore need some version of SQ/USQ if you are planning to download from RCPMs.

Data encryption

For those who require some security either in storing files or in transmitting them, an encryption/decryption program by Ward Christensen, called **SCRAMBLE**, is available on CPMUG Vol. 36. Ward cautions, however, that although he knows of no way of unscrambling a file if the password is lost, he makes no claim to being a cryptography expert and does not guarantee the security against determined attack by experts. He also cautions that, since the data is encrypted "in place" without creating a backup file, a disk error may make the encrypted file impossible to recover. With these caveats, however, the program is recommended for those who need some degree of security for sensitive files.

Where to get the programs

I was reminded that I have not listed sources since the first of these columns (*Microsystems*, March 1983.) Here, then, are the sources of public domain software.

1) **SIG/M Software**
Box 97
Iselin, NJ 08830

2) **CP/M Users Group**
1651 Third Avenue
New York, NY 10028

3) Your local computer club (the preferred source)

4) RCPM systems—see July '83 *Microsystems* for list.

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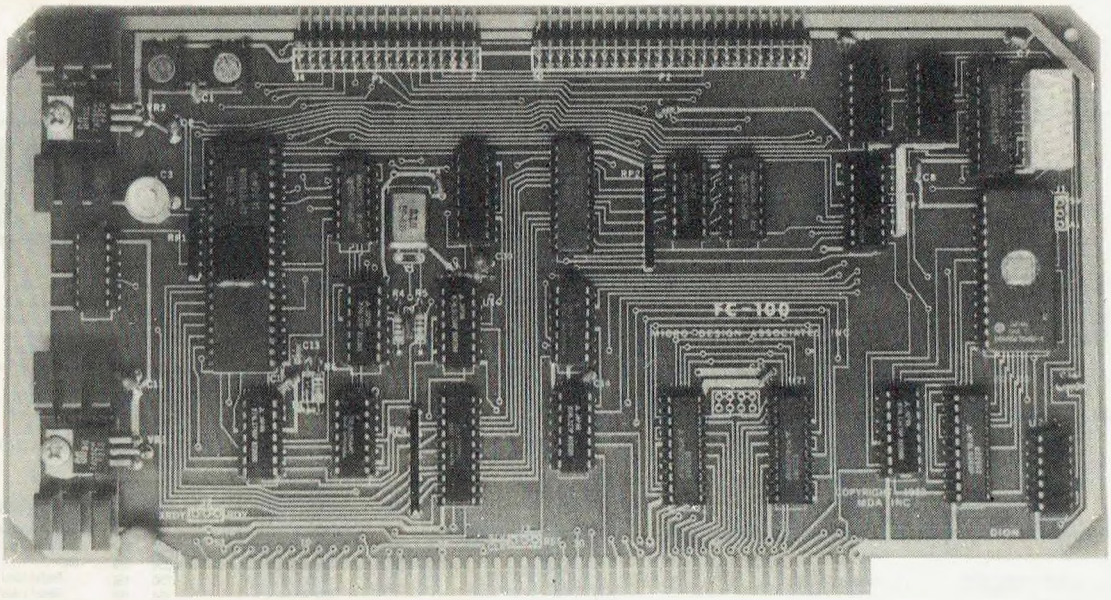

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IBM

IBM PC SOFTWARE (PC/MS DOS)

Business

		LIST	SALE
American Training International			
Power for PC DOS		75	56
Power for Multiplan		75	56
Wordstar Combo		75	56
Ashton-Tate			
Financial Planner		700	479
Friday		295	198
dBASE II		700	389
• w/users guide		729	409
Aspen Software			
Grammatik		75	56
Proofreader 32K		50	38
Proofreader 50K		50	38
Proofreader 80K		50	38
Best Products			
Personal Financial Pgm		95	64
Comprehensive Software Support			
PC Tutor 2.0		60	45
Continental Software			
FCM (First Class Mail)		125	79
Home Accountant Plus		150	94
Emerging Technology			
Edix		195	148
Wordix		195	149
Edix + Wordix		390	289
Edix/Wordix/Spellix	[5]		325
Howard Software			
Real Estate Analyzer		250	185
Information Unlimited Software			
Easy Planner		250	178
Easy Speller 2		225	129
Easy Writer II		350	195
Lexisoft			
Spellbinder		495	229
Lifetree			
Volkswriter		195	119
Mark of the Unicorn			
The Final Word		300	199
Mince		175	139
Metasoft			
Benchmark Mail List		250	179
Benchmark Word Processor		500	299
Micro Pro			
Mailmerge		250	165
Spellstar		250	165
Word/Mail	[5]	695	426
Word/Spell	[5]	695	426
Word/Spell/Mail	[5]	845	558
Wordstar	[5]	495	327
Microsoft ®			
Multiplan™		275	169
Multitool Budget			109
Multitool Financial			69
Northwest Analytical			
Statpak		495	369
Oasis			
Punctuation & Style		125	99
The Word Plus		150	105
PBL Corporation			
Personal Investor		145	98
Peachtree			
SERIES 4 PAK (GL,AR,AP)	[5]	595	349
Select Information Systems			
Select Word Processor		595	329
Software Arts			
TKISolver		299	219
Software			
Multimate			340
Sorcim			
Supercalc		195	115
Supercalc 2		295	159
Visicorp			
Visicalc		250	159
Visispell		225	159
Visiword		375	269
Visischedule		300	195

Database

		LIST	SALE
Alpha Software			
Mail List		95	65
Database Mgr II		295	269
Applied Software Technology			
Versaform		389	245
Ashton-Tate			
dBASE II	[5]	700	389
dBASE II w/user's guide	[5]	729	409
Conceptual Instruments			
Desk Organizer			245
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Condor 3		650	398
Fox & Geller			
Quickcode		295	175
dGRAPH		295	189
dUTIL		99	59
FYI, Inc.			
Superfile		195	129
Humansoft			
DBPlus		125	95
Information Unlimited Software			
Easy Filer		400	249
Innovative Software			
TIM III		495	279
Link Systems			
Data Fax		299	224
MDBS			
Knowledge Man		500	327
Micro Pro			
Infostar	[5]	495	327
North American Business Systems			
< < Answer > >		250	159
Optimal			
Accelerator			195
dCLONE			295
Software Publishers			
PFS: File		140	95
PFS: Report		125	79
Supersoft			
Personal Data Base		125	93
Visicorp			
Visifile		300	195

Home/Education/Games

		LIST	SALE
Bible Research			
THE WORD Processor			144
Blue Chip			
Millionaire		100	75
Friendly Software			
PC Intro. Set		50	38
Infocom			
Deadline		50	37
Starcross		40	30
Suspended		50	38
Zork I		40	30
ISM			
Mathemagic		90	65
Lightning			
Master Type		50	38
Microsoft ®			
Flight Simulator™		50	38

Language

		LIST	SALE
Digital Research			
SID86		150	94
Microsoft ®			
CBASIC 86		200	150
C Compiler™		500	349
Mumath/Musimp™		300	225
muLisp/MuStar™		250	188
Ryan-McFarland			
RM/Cobol			
Full Dev System		950	713
RM/Cobol Runtime Only		250	188

Utility/Comm/Graphics

		LIST	SALE
Alpha Software			
Apple-IBM Connection		195	129
Typefaces		125	79
Byram Software			
BSTAM		200	149
BSTMS		200	149
Central Point			
Copy II PC		40	35
Hayes			
Smartcom 2		119	79
Innovative Software			
Fast Graphs		295	159
Insoft			
Data Design		225	169
ISM			
Graphmagic		90	65
Graphmagic Combo		150	119
Microstuf			
Crosstalk/ Smartmodem		195	119
Peter Norton			
Utilities		80	59
Visicorp			
Visitrend/Plot		300	195
Woolf			
Move It		150	99

IBM PC HARDWARE

		LIST	SALE
Corvus			
PC Interface, Cable, Man.		300	239
Hayes Microcomputer Products			
Smartmodem 1200B	[5]	599	439
Hercules			
Graphics Card		499	359
Microsoft ®			
Mouse™		195	149
Programming International			
PC-Hayes Cable		35	29
QCS			
Big Blue		595	449
Quadrum			
256K QUADBOARD		595	435
64K Quadboard		395	269
TG Products			
Joystick		65	49
Tandon			
TM100-2 Drive (5¼" DS)	[5]	650	249

PC SOFTWARE CP/M-86

		LIST	SALE
Ashton-Tate			
dBASE II	[5]	700	389
Fox & Geller			
Quickcode		295	175
dGRAPH		295	189
dUTIL		99	59
Digital Research			
CBASIC 86		200	150
CP/M-86		60	45
Pascal MT+86 With SPP-86		600	450
Concurrent CP/M 86		350	249
Woolf			
Move It		150	99

APPLE

APPLE II/II– DOS ®

Business

		LIST	SALE
Artsci			
Magic Mailer		70	49
Magic Window II		150	99
Magic Words		70	49
BPI			
AP		395	295
AR		395	295
Inv		395	295
Broderbund			
General Ledger w/AP		495	305
Bank St. Writer		70	45
Continental			
CPA #1,2,3,4 (ALL 4)	[5]	1000	609
CPA #1-GL		250	159
CPA #2-AR		250	159
CPA #3-AP		250	159
CPA #4-PAYROLL		250	159
FCM (First Class Mail)		100	68
Home Accountant		75	52
Decision Support			
Accountant With DBCALC		149	112
Accountant		129	97
Hayden			
Piewriter/ Multi 80 Column		150	99
Kensington			
Format II		150	113
LJK			
Letter Perfect W/Mail Merge		150	112
Microsoft ®			
Multiplan™		275	169
Multitool Budget		150	109
Multitool Financial		100	69
Time Manager		150	115
Muse			
Supertext Home Office		125	79
Supertext Professional		99	65
PBL			
Personal Investor		145	99
Program Design			
New Step by Step		80	50
Sensible			
Sensible Speller		125	85
Sierra On Line			
Dictionary		100	69
Screenwriter II		130	85
Screenwriter Professional		200	149
Silicon Valley			
Word Handler		199	139
Sof/Sys.			
Executive Speller		75	56
Software Dimensions			
Accounting + II GL		395	289
Accounting + II AR		395	289
Accounting + II AP		395	289
Accounting + II Inventory		395	289
Accounting + II Payroll		395	289
Synergistic			
Global Program Line Editor		65	49
Visicorp			
Business Forecasting Model		100	78
Visicalc		250	159
Visiplot		200	156
Visischedule		300	195

Database

		LIST	SALE
AST			
Versaform		389	245
Micro Lab			
Data Factory		300	216
Muse			
Address Book		50	36
Silicon Valley			
List Handler		90	68
Software Publishers			
PFS: File		125	85
PFS: Graph		125	85
PFS: Report		125	79
Stoneware			
DBMaster		350	260
DBMaster/Hard Disk		499	359
Statpak		99	71
Utility Pak 1		129	96
Utility Pak 2		129	96
Synergistic			
Modifiable Database		80	59
Visicorp			
Visifile		250	159

Home/Education/Games

		LIST	SALE
Beagle Brothers			
Alpha Plot		40	28
IUS			
Telstar Level I		40	30
Telstar Level II		80	58
Lightning Software			
Master Type		40	30
Micro Lab			
English SAT #1		30	22
Learning System		150	108
US Constitution Tutor		30	22
Microsoft ®			
Typing Tutor II™		25	19
Quality Software			
Bag of Tricks		40	30
Sensible			
BEST		40	30
Synergistic			
Stargazer's Guide		30	23

Language

		LIST	SALE
Microsoft ®			
Applesoft Compiler (TASC)™		175	119
Mumath/Musimp (ADIOS)™		250	194
μLisp/μStar		200	156
Terrapin			
Logo		150	119

Utility/Comm/Graphics

		LIST	SALE
Avant Garde			
Ultra Plot/DIF/Datagraph		99	71
HiRes Secrets		125	94
Beagle Brothers			
Apple Mechanic		30	22
Beagle Bag		30	23
DOS Boss		24	17
Double Take		35	27
Pronto DOS		30	23
Utility City		30	22
Central Point			
Copy II+		40	35
Crane			
Menu Generator		40	29
DataSoft			
Micro Painter		35	25
Hayes			
Terminal Program		100	75
Insoft			
Electric Duet		30	23
Graforth II		75	56
Link Systems			
Link Index		195	149
Link Video		55	42
Lotus			
Executive Briefing System		199	149
Muse			
Dataplot		60	43
Omega Microwave			
Inspector		60	49
Penguin			
Comp Graphics/ Apple Tablet		120	86
Complete Graphics System		70	50
Graphics Magician		60	39
Special Effects		40	30
Special Effects Apple Tablet		70	50

CIRCLE 92 ON READER SERVICE CARD

what you want . . .

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Sensible		
Disk Organizer	30	23
Disk Recovery	30	23
Image Printer Epson	40	30
NEC Dot Matrix	40	30
Multi Disk Catalog	25	19
Super Disk Copy	35	26
Sirius		
Pascal Graphics Editor	100	75
Southeastern		
Data Capture Videx	90	65
Southwestern Data		
ASCII Express		
Professional	130	89
Printographer	50	38
Zterm Prof.	150	109
Videx		
Videoterm Utilities Disk	37	28
Visicorp		
80 Col prebook/Apple	29	21
80 Col prebook/Visicalc	49	27
Soft Video Switch	35	25
Visiterm	100	79
Visitrend/Plot	300	195

APPLE III™

	LIST	SALE
Visicorp		
Business Forecasting Model	100	78
Visischedule	300	195
Link Systems		
Data Fax	249	187
Software Publishers		
PFS: File	175	129
PFS: Report	125	79

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Sierra On Line		
Screenwriter II	130	85
Software Publishers		
PFS: File	125	85
PFS: Graph	125	85
PFS: Report	125	79
Visicorp		
Visicalc	250	159

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Hardware

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Wildcard (for IIe only)	130	109
Hayes		
Micromodem II	379	259
w/Term Pgm	409	289
Kensington		
System Saver Fan	90	69
Kraft		
Joystick	45	
LJK		
Lower Case Char Gen	25	19
Microsoft ®		
16K RAM Card™	100	69
Premium System™ [5]	695	489
Softcard™	345	219
Now Premium Card™	495	369
Personal Computer		
Applicard (6MHz)	375	305
TG		
Joystick	60	45
Videx		
Enhancer II	149	99
Ultraterm	379	279
Videoterm with Softswitch	375	239

CP/M

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Bottom Line Strategist	400	269
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Grammatik	75	56
Proofreader (32K or 80K)	50	38
Designer Software		
Palantir	425	299
Dictronics		
Random House Thesaurus	150	102
Digital Research		
Display Manager	400	295
Epic		
Supervyz	150	94
Mark of the Unicorn		
The Final Word	300	199
Mince	175	127
Metasoft		
Benchmark Mail List	250	182
Word Processor	500	299
Micro Pro		
Calcstar	145	96
Mailmerge	250	129
Spellstar	250	128
Starindex	195	150
Word/Mail [5]	695	347
Word/Spell [5]	695	347
Wordstar Prof. (Word/Spell/Mail) [5]	845	395
Wordstar [5]	495	248
Microsoft ®		
Multiplan™	275	169
Multitool Financial	100	69
Multitool Budget	150	109
Northwest Analytical		
Starpak	495	369
Oasis		
The Word Plus	150	105
Punctuation & Style	129	99
Organic		
Milestone	295	229
Select		
Select Word Processor	595	329
Sorcim		
Supercalc	195	115
Supercalc 2	285	159

Database

	LIST	SALE
Anderson-Bell		
Abstat	395	339
Ashton-Tate		
dBASE II	700	389
dBASE II w/user's guide	729	409
Friday	295	198
Caxton		
Cardbox	245	177
Condor		
Condor 3	650	395
DJR		
FMS 80	395	275
Digital Research		
Access Manager	300	219
FYI		
Superfile	195	112
Fox & Geller		
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Quickscreen/dBASE II	149	119
dGRAPH	295	190
dUTIL	99	58
Human Soft		
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Micro Pro		
Infostar	495	327
Microsoft ®		
Sorting Facility (MSORT)™	195	151
Pearl Soft		
Personal Pearl	295	221
T/Maker Co.		
T/Maker III	275	215

Home/Education/Games

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Infocom		
Deadline	60	43
Starcross	50	38
Zork I	50	38
Zork II	50	38
Zork III	50	38
Suspended	50	38
Supersoft		
Dungeon Master	40	30
Nemesis	45	34

Language

	LIST	SALE
Digital Research		
CB80	500	369
CBASIC	150	94
PL/1 80	500	375
Pascal MT+	350	262
Pascal MT+ with SPP	500	395
RMAC	200	150
SID	75	63
ZSID	100	88
Microsoft ®		
Basic 80 Interpreter	350	249
Basic Compiler	395	285
Cobol 80	750	562
Fortran 80	500	345
MACRO 80	200	150
μLisp/μStar	200	156
Supersoft		
ADA Compiler	300	225
C Compiler	250	188

Utility/Comm/Graphics

	LIST	SALE
Byram		
BSTAM	200	149
Digital Research		
Despool	50	38
Microstuf		
Crosstalk/Smartmodem	195	117
Supersoft		
Disk Doctor	100	75
Wooli		
Move It	125	83

HARDWARE, NOT MACHINE SPECIFIC

	LIST	SALE
Amdek		
Color II (RGB)	899	645
Hayes Microcomputer Products		
Chronograph	249	199
Smartmodem 1200	699	499
Smartmodem 300	279	209
NEC		
Monitor 12" Green Hi-Res	285	167
Novation		
J Cat	149	119
Smart Cat 103	259	207
Smart Cat 103/212	595	476

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WHY PAY MORE?

Letters to the Editor

Dear Mr. Libes,

A friend brought your August issue to my attention, specifically the article by Ian Ashdown and his "XERA" program. For his (and your readers') information, a program is available upon most Remote CP/M systems called "ERAQ", which accomplishes the same ends as the XERA program. I wrote this program and released it to the public domain over a year ago. An article describing this program was published in *Lifelines* (September 1982). The primary difference between the two programs is that ERAQ will remove any SYSTEM or READ-ONLY protection if erasure is requested.

Thomas N. Hill
200 Oklahoma St.
Anchorage, AK 99504

Dear Mr. Libes,

This is to record one correction and two cautions regarding my article, "Customize your Word processor Keyboard" (*Microsystems*, June 1983, p. 106). The first two items were called to my attention by Allen Alexopulos of Annapolis, MD.

The correction: In Note 2, the jumper "connecting pins 3 and 14" should connect pins 4 and 13.

Caution one: The DI . . . . EI pair with the call between may not be where I found it in my copy of Lifeboat's BIOS. In Allen's it was a few bytes away. The user should (*1*) use DDT to find this instruction pair (F3 . . . . FB), (*2*) note the location of and the address following the CALL (CD) between the DI and the EI, (*3*) put the location of the CALL (that is, where it was found in the DDT dump) in the statement CCALLA EQU . . . ., and the address called in the statement DROUTN EQU . . . . Remember that addresses are in memory, and therefore in the DDT dump, low byte first, so that the two bytes must be reversed when inserting them in the EQU statement. You can get the address right-side-to from DDT by using the L command, Lxxxx, where xxxx is the address of the DI instruction.

Caution two: I recently got a new Z29 terminal (very nice, except for an idiotic location of the BREAK key), and found that on rapid repeated-key input from the cursor keys I

was getting stray characters. I discovered that this terminal does not always send the second character of an ESC sequence immediately after the first. In this case the wait-count CHRLEN in my listing needs increasing. This can be tried by replacing the 61 hex (just before location INTRY) to FF in the BIOS. If the trouble goes away, then redefine

```
HRLEN EQU Z80MHZ*6000/CBAUD
```

and reassemble. I know of no harm that comes from increasing this constant even further if needed.

H. Bradford Thompson
The University of Toledo
Toledo OH 43606

Dear Mr. Libes,

I totally agree with David Fiedler's conclusion about the Supersoft C compiler (*Microsystems*, September 1983, p. 44). I have spent approximately 160 hours attempting to use version 1.2. Some of the bugs encountered include:

- the optimizer produces erratic results unless the optimization switch is shut off during the C2 step.
- the dowhile and goto features do not work.
- review of the distributed C source libraries shows many examples of unstructured code with multiple function exit points, little or no documentation, and other poor design practices.

I also encountered similar problems with version 1.1 of the Supersoft C compiler.

Again, congratulations to Dave Fiedler for publicly identifying a poor product.

William E. Hatch
Automated Sciences Group, Inc.
Rt. 2, Box 708
King George, VA 22485

Dear Mr. Libes,

Richard Balocca's response to the review of his company's C compiler by David Fiedler ("The Supersoft C Compiler," September 1983) contained a misleading statement. He implies that Supersoft C is the only compiler that supports UNIX-compatible I/O functions with no "sensitivity" to CP/M's 128-byte record size. In other words, it has the ability to seek within a file and change as little as one byte at a time. "Try this with any other CP/M C compiler," he says.

Whitesmiths' C, when used with KADAK Product's Real-Time C Library ($95 for the object library), supports these portable I/O conventions. *[See p. 151.—Editor]*

Unlike Supersoft's compiler, the executable program may be distributed without paying any royalties, and the program does not display any copyright notices when it runs.

G.S. Fawcett
Analyst
Kadak Products Ltd.
206-1847 West Broadway Ave.
Vancouver, B.C., Canada
V6J 1Y5

Dear Mr. Machrone,

I recently read your terminal test report article in the March 1983 *Microsystems*. This is the *only* article on terminals I've read in the eight months or so that I've been researching personal computers. It is also one of the most comprehensive, best organized, best written, and most forthright computer equipment review articles I've ever read. Since you seem to be quite knowledgeable about terminals (unlike almost everybody else I've talked to), I am hoping you can answer some questions I have.

Until recently, all the personal computers I've considered buying didn't need a terminal. I've since become interested in a couple (Sage and CompuPro) that do need one. But nobody seems able to give me definitive information about their capabilities and limitations. I will greatly appreciate any info or answers you can give to the following questions:

1) The question I've had the most trouble getting answered is whether

you can do bit-mapped graphics on a *standard* terminal, such as those you reviewed. Some people say no, some say yes, some say maybe and most obviously don't know. *Can* a standard terminal display bit-mapped graphics? If not, can it be modified or have a circuit card added to enable it to do so?

2) Have you revised your evaluation of any of the terminals you reviewed? Do you still think the Visual 50 (and the 55, with function keys, which I would prefer) is the best terminal for the price? Are there any significantly better terminals available for a little more money ($800-900)? Most of my initial uses will be text-related, so I think quality of text display would be the most important characteristic for me.

3) What is N-key rollover and why is it desirable?

4) The Visual has its cursor control keys at the top (or back) of the keyboard. This seems quite inconvenient to me. What do you think?

5) Can a terminal's cursor keys and function keys be made to work with programs (such as word processors) easily (assuming the software allows for it)?

6) What is meant by "smart" terminal and "dumb" terminal?

7) Do these terminals (and others in this price range) have keyboard buffers (to prevent out-typing the display and losing characters)?

8) You mentioned several of the terminals' transmission rates in the article. Is this very important? Most of them seemed unreliable at the highest rates. Are more expensive terminals better in this regard? I would think the higher the rate, the better.

9) On p. 88 of your article, you said ". . . neophyte users have no idea of the potential offered by properly designed terminals. . . ." Could you elaborate on this?

Thank you very much for your time and effort. Keep up the good work.

Doug Hazen, Jr.
1935 N.W. 31st Pl.
Gainesville, FL 32605

Bill Machrone replies:

No low-end terminal displays bit-mapped graphics. Most have character graphics, which is nothing more than a special character set useful for drawing forms on the screen. Bit-mapped or pixel graphics require far more memory, since you have to be able to turn each pixel on or off independently. Add-in boards are available for many low-end terminals, and we will be reviewing one in an upcoming issue. They typically have 512 × ??? resolution—less than what you would find, say, in an IBM PC or Apple in high-res mode, but good enough for most applications. The biggest problem you are likely to encounter using bit-mapped graphics is printing the images you create on the screen. There are hardware and software solutions, but shop carefully for compatibility before you buy. Take nothing on faith; see a demo. Compare the cost of a terminal with built-in bit-mapped graphics to that of an add-in board, taking into account the features you need.

N-key rollover is a feature that pre-

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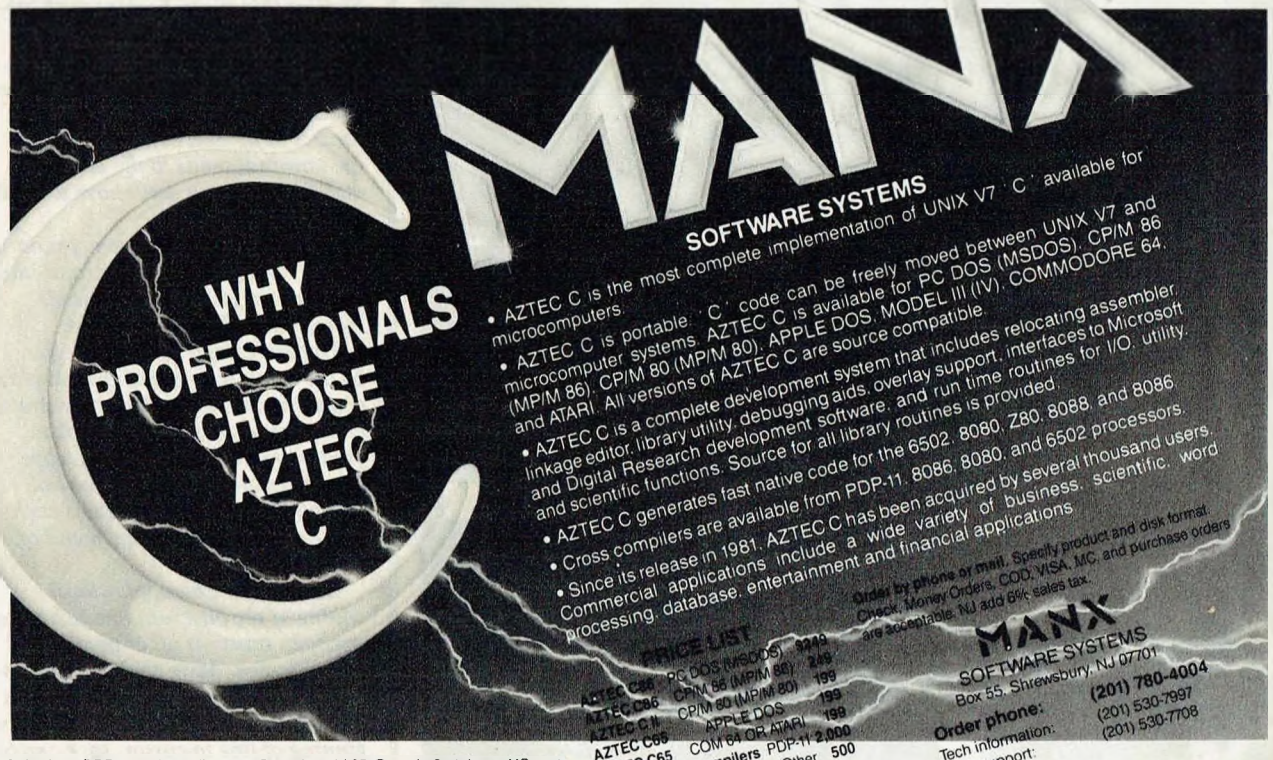
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vents the keyboard scanning and decoding circuitry from getting confused when multiple keys are pressed at once. For example, if I type the word "berth," the e, r and t are adjacent to one another under the fingers of my left hand. I might press each of them in turn, without releasing the first one before pressing the second or even the third. The keyboard encoder should not only discern the order in which I press them, but not be limited in how many can be pressed simultaneously. Furthermore, it must not make mistakes when two or more are held down. A keyboard with 2-key rollover will not "see" the t in the above example, but will miss the keystroke. Some terminals will begin to make mistakes after four or so keys are depressed, but that isn't likely to be a problem. Given human physiology, it might as well be n-key rollover.

I still haven't found a terminal I like better than the Visual 50 at the low end, although there are a few that sound good. The Qume and Liberty products are attractive, as is the new Lear Siegler 24E. I haven't tested them yet, but they have the proper specifications.

The reason high baud rates are desirable is that they are the upper limit on how fast you can fill the screen with characters. In word processing applications, where the screen is likely to be densely filled with characters and the software may be transmitting a large number of escape sequences to position the cursor, a high baud rate can make the difference between a boring, difficult process and a pleasure. 19,200 baud is very desirable for word processing applications, although even high-overhead programs such as WordStar are acceptable at 9600 baud.

The location of cursor and function keys is a personal choice. I tend not to use cursor keys much, preferring WordStar's control key arrangement. Function keys can be anywhere on the board, although the horizontal arrangement is best if you want to take a line on-screen to label them.

It isn't easy to implement function keys in a program that wasn't designed for them. For an example of what you have to go through, refer to my article in the June 1983 issue of Microsystems. *It gives some assembly language patches that fully utilize the function keys on the Zenith Z-19. Similar things can be done with other terminals, but not without some experimentation.*

It is far easier to use terminals that have programmable function and control keys. You can control what the terminal sends to the program, and therefore you don't have to modify the program.

There is no agreed-upon standard for the use of dumb, smart, and intelligent as they apply to terminals. Here's what they mean to me:

Dumb: *(coined by Lear Siegler, by the way): A terminal that displays characters as received and transmits characters as keyed. Responds to predetermined control and escape sequences to effect cursor control and other, minimal functions such as clear screen and clear to end of line.*

Smart: *The above, plus local editing of the onscreen image and capacity to transmit all or part of an edited screen. More sophisticated escape and control sequences, such as clear foreground fields, clear from beginning of line to cursor, save and/or report cursor position, etc.*

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Letters continued . . .

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All but the very dumbest terminals have some degree of keyboard buffering, often implemented in conjuction with n-key rollover.

Finally, the neophyte user has no frame of reference to gauge the power that most terminals have to offer. For instance, in configuring WordStar for a terminal not on the menu, you have some choices as to whether some processes will be done by the terminal (in hardware) or by WordStar (in software). It takes time and experimentation to determine what works best, or if it works at all. Some features that should work, according to the documentation, don't. At least they don't do what you expect. You have to train yourself to think like the terminal thinks so you can program it accordingly. Some people are unprepared or unwilling to exert the necessary mental energy.

The terminal manufacturers could help immensely by improving their documentation and the implementation of the features. For example, the Visual 50 has an excellent setup mode. The Zenith Z-19 uses switches, primitive by comparison. Zenith's designers allow you to override any and all of the switch settings through escape codes. The Visual doesn't offer that freedom. They assume that the user will control all setup modes from the keyboard. Granted, you don't often need it, but sometimes it's nice to be able to change the cursor type (block or underline) from within the software or to toggle the way the terminal handles carriage returns. You have to know what questions to ask before you can determine if the answers are satisfactory.

Dear Mr. Terry,

To set the record straight regarding your description of LINASM (*Microsystems*, August 1983, p. 22): When CBBS became too large, I

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wrote COMBINE to combine its pieces and strip comments so as to create a work file to assemble. When that got out of hand, I modified Digital Research's uncopyrighted ASM 1.0 to make LINKASM (now often called LASM). CBBS may thus consist of many relatively small .ASM modules (perhaps 8-30K) that LASM combines.

Just thought I'd let you know that whoever said LASM was created to assemble MODEM gave you a bum steer.

Ward Christensen
688 E. 154th St., Apt. 7G
Dolton, IL 60419

Dear Mr. Libes,

I recently discovered a "bug" in "ZSID.COM", Digital Research's Z80 version of "SID.COM" (Symbolic Instruction Debugger). This is probably the most powerful tool in my software library. I was rather concerned that a bug existed and so I contacted my dealer, who sent Digital Research the following software performance report on my behalf:

"ZSID does not understand some 16-bit number arguments properly. For example, the hex number FFFF is not even allowed unless preceded by 0 such as 0FFFF. This is completely different from the convention used in SID or DDT. Also, the number 0FFFF is interpreted as 00FF, which is completely incorrect. The number -1 is also not correctly interpreted. For example: LD HL,-1 is interpreted as LD HL, 00FF."

My dealer received the following reply from Digital Research and forwarded the same to me:

Thank you for your recent software performance report concerning ZSID v 1.4.

The problem which you are experiencing is the result of a known bug in ZSID. ZSID cannot assemble above 0FF7FH. All values above this will "wrap" around and appear as 0080-00FFH. No patch exists for this problem and none is contemplated.

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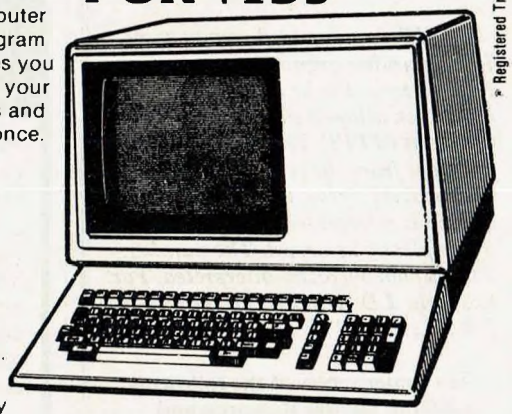

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Letters continued . . .

I apologize for any inconvenience that this causes you.

Sincerely,
Lynda J. Haigh
Technical Support Analyst

I personally feel that this type of response is as bad as no response at all. A corporation as large as Digital Research, Inc., certainly should be concerned with producing the best software possible. If they are not willing to repair a known bug in their software, then perhaps they should remove it from the market and refund the purchase price to any registered owner. If Digital Research does not have the manpower to solve the problem, then I will be happy to help them out (for a nominal fee, of course), assuming that they are willing to supply the source code.

Elliott Myron
Engineering Specialist
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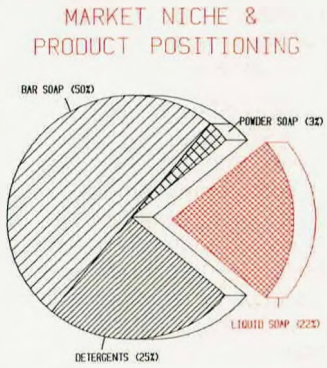

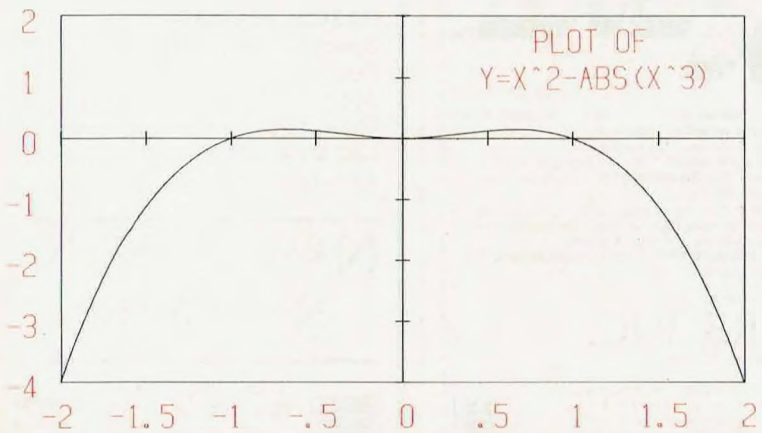

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CIRCLE 186 ON READER SERVICE CARD

The CP/M Bus

by Anthony Skjellum

In the last CP/M Bus installment we began discussing CP/M-86. Part of that column was a section on BDOS-86 calls that differ from CP/M 2's BDOS calls. In this column, we won't complete that discussion as originally planned. This will be postponed for a future column and, instead, we will discuss CP/M disk format incompatibilities and a possible software solution for software producers/distributors.

In future columns, we plan to return to CP/M-86 topics. We look forward to reader input concerning the CP/M-86 and CCP/M-86 operating systems. Input on CP/M-68K would also be appreciated.

Format incompatibilities

One of CP/M's original strengths was software compatibility. Software written according to CP/M conventions and without hardware dependencies could be used unmodified on other CP/M systems with similar memory and disk capacities. The 8" (single-density) disks made by CP/M computers were interchangeable. However, with the recent explosion in the number of 5.25" floppy-based computers, a myriad of incompatible disk formats has also arisen. On the surface, software production for all these formats seems prohibitively expensive.

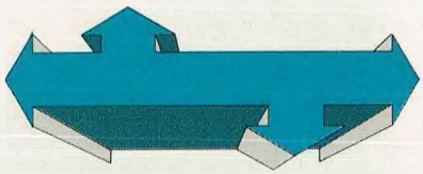
Traditional solutions

The trivial solution for a software producer is to use a distributor or formatting service to produce the various formats he requires. This is certainly a viable method, but does have its drawbacks. It is not our purpose to discuss this avenue but instead to discuss a novel way in which an individual producer can solve the problem inexpensively.

Instead of using a formatting service, the software producer could elect to purchase a subset of the existing machines and make formats for those only. While this is expensive, it could be very workable, provided that the computers can be connected efficiently for the purpose of intercomputer data transfer.

A software solution

A new way to handle this problem would be through software capable



of creating various formats on a single computer. In the remainder of this column, we will discuss such a program, called **VDISK**, which effects format conversion on an IBM PC computer.

Background

VDISK is distributed by CompuView Products, Inc., of Ann Arbor, Michigan. In order to run VDISK on the IBM PC, the CompuView version of CP/M-86 must first be purchased. CompuView CP/M-86 costs $350, but provides some features above those of standard CP/M-86. (CompuView CP/M-86 uses its own disk format, but Digital Research CP/M-86 format is supported by VDISK.)

The IBM PC configuration for use with VDISK is extremely important. IBM sells PCs with 40-track dual-sided drives. The PC's disk controller can also handle 80-track drives, and CompuView CP/M-86 supports the use of these drives in making formats for computers such as the DEC Rainbow and Eagle II, which use 80-track drives. Thus, if 80-track formats are to be created using VDISK, the proper 80-track drive or drives must be added to the PC. This may be done by installing an 80-track B: drive, but for formatting convenience, two 40-track drives are preferable. This leaves the alternative of installing an external cabinet with one or two 80-track drives.

The choice of 80-track drives is important because not all brands work equally well in creating formats for other computers. To avoid problems, CompuView offers a disk subsystem with either one or two Tandon 100-4 drives. This subsystem sells for $750 with a single drive and at $1,150 with two drives. Again, for maximum formatting convenience, two drives are preferable. Bare Tandon 100-4 drives are also available from CompuView for $350 each.

From the above discussion, it should be obvious that the optional hardware required for creating 80-track formats is nontrivial. Most formats are still 40-track, so the software producer may opt to add the 80-track sub-system later when more 80-track formats appear.

8" standard format

CompuView CP/M-86 does not support the use of an 8" disk subsystem. Thus, a separate computer unit must be available for this purpose. This just means that your 8-bit development system must have 8" disk drives. Software such as **MOVE-IT** (Woolf Software Systems), or **MODEM7**, can then be used to transfer data between the two systems. (CompuView sells a version of MODEM7 for CP/M-86.)

Incorrigibles

VDISK is very powerful, but there are some formats which it cannot produce. 40- and 80-track Tandon drives cannot be used to make single density disk formats. This prohibits the production of Apple format, and Osborne single-density format. Furthermore, it cannot be used to make hard-sectored formats such as North Star and Micropolis. Finally, it can't be used to produce formats for machines such as the Victor 9000 (Sirius I) because that computer uses constant linear velocity drives and Group Code recording, a form of data compression.

Currently supported formats

VDISK does support a large number of formats, including many popular ones. What follows is a list of formats supported as of September, 1983. The following may be formatted with the standard IBM 40-track two-sided disk drive:

Format	*Tracks used*
IBM (DRI) CP/M-86	40
IBM (DRI) CCP/M-86	40
NEC PC8000	40
DEC VT-180	40
Superbrain	40
Morrow Decision	40
Kaypro	40
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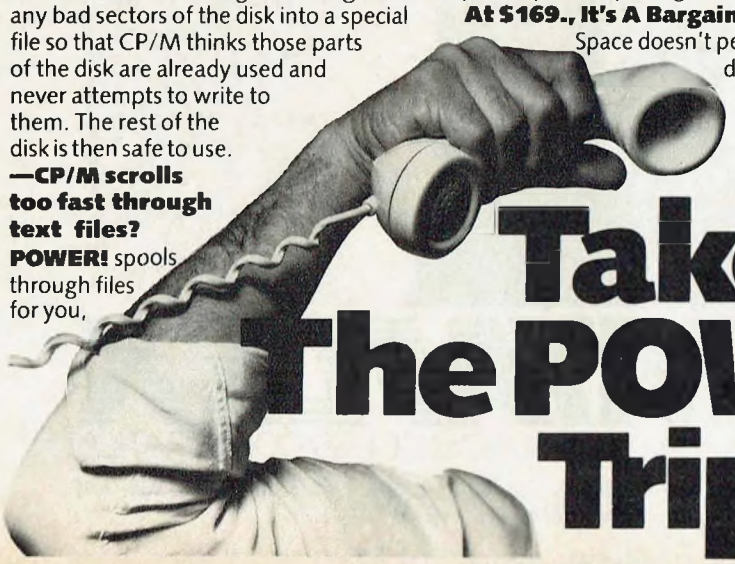

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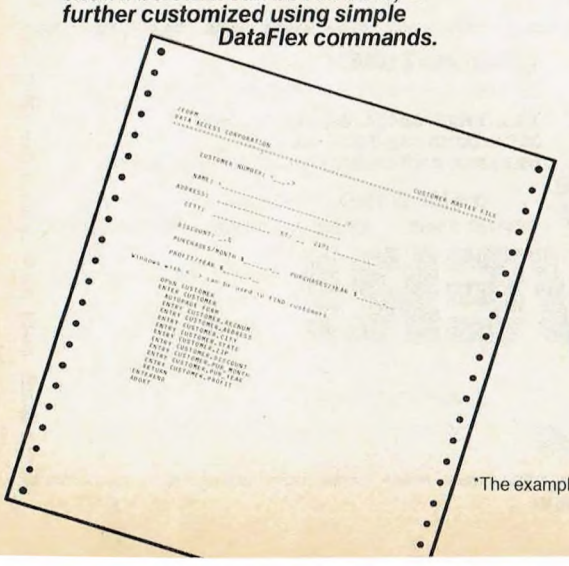

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*The example program is for adding, finding, deleting, and editing data fields in a typical customer database.

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HP 87/125	35
Xerox 820 II	35
Zenith/Heath Z89	40
Zenith/Heath Z100	40

The following can be formatted using the Tandon 100-4 drives:

Format	*Tracks used*
DEC Rainbow	80
Eagle II	80
NCR Firststep	80
Altos	80
Seiko	80

Thus, 20 CP/M formats are currently supported by the software.

VDISK is not an inexpensive package. The base price for licenses sold to software distributors is $500. In addition to this, each format selected is $40 extra. IBM CP/M-86 and CCP/M-86 formats are included free with the license fee. As mentioned above, CompuView CP/M-86 must also be purchased. Retail pricing for CompuView CP/M-86 starts at $350.

CompuView prepares VDISK copies on an individual basis, and equips them with the software formats purchased. When additional formats are required, the update fee is just the $40 per format added. When new formats are purchased, a completely new VDISK distribution disk is shipped, containing the enhanced formatting capabilities. Updates and general improvements, which are released on an irregular basis, are also $40. An update always includes a complete VDISK distribution disk.

Retail pricing for VDISK is higher. Check with CompuView for their latest pricing schedule.

The VDISK manual is a 20-page loose-leaf document. Only about 1½ pages are devoted to instructions. The remainder consists of information on formats, and general information on the VDISK concept. This seems somewhat scant at first glance, but proves no real hindrance since the VDISK components are menu-driven and trivial to operate. A discussion of VDISK's two components follows next.

- **The DSKFMT program** is used to format a disk in a specified format. The program is executed as follows:

```
A>DSKFMT drv:
```

where drv: is the drive to be formatted (if no drv: is specified, B: is assumed). DSKFMT signs on with its list of formats and requests selection from that menu. Once an option is selected, DSKFMT attempts to format the disk in drv: in the specified format. After completion, DSKFMT displays its menu again, should the user wish to format another disk.

- **SELECT:** changes the format that CP/M-86 expects for a given disk drive. SELECT is also menu-driven, and the drive is specified when SELECT is executed, as for DSKFMT.

Once a drive has been SELECTed for a given format, disks of that format may be loaded into the drive. The disk acts just like a regular CP/M-86 disk, but with the characteristics of the chosen format. This makes it simple for existing configuration software to work unmodified in conjunction with VDISK. The format remains in force between warm boots, and a drive's format may be changed at any time by running SELECT.

SELECT lacks one feature that often leads to inconvenience. It is not

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possible to deSELECT the special format of a drive and return the drive to its standard CompuView 40- or 80-track format. In order to accomplish this, a cold boot must be performed. This feature is sorely missed and should really be added to the SELECT program.

PC-DOS disks

CompuView CP/M-86 supports file transfer between 8-sector per track, single-sided, IBM PC disks and CP/M-86. A program called **IBMPIP** is provided to perform this function. It can copy in either direction, but cannot use wildcards to simplify operation. By using IBMPIP, source files and other data may be transferred between CP/M and PC-DOS. In conjunction with VDISK, this permits flexible format conversion between the 8- and 16-bit worlds, and across operating system boundaries.

It would be very useful if IBMPIP were able to read double-sided, 9-sector-per-track disks. This would more than double the amount of data one could place on a single disk. As it stands now, files moved from 9-sector-per-track disks don't transfer properly (but no error message is displayed.) As currently set up, IBMPIP will not transfer files from PC-DOS disks to a disk drive whose format has been set by SELECT. This is a minor inconvenience which should be possible to remove.

Rainbow disks

DEC sells preformatted disks for the DEC Rainbow; users are not provided with formatting software for the Rainbow computers. With VDISK, DEC format disks can be created. Using VDISK could save Rainbow software producers a considerable amount on blank disks alone. Blank disks produced with VDISK could conceivably be sold to end users as a product unto themselves.

Conclusion

In this column, we have discussed CP/M disk incompatibilities and a software package called VDISK that permits conversion between many formats using an IBM PC. VDISK is not an inexpensive package, but costs less than the cheapest machine whose format it emulates.

Look for more about CP/M-86 in the next few columns.

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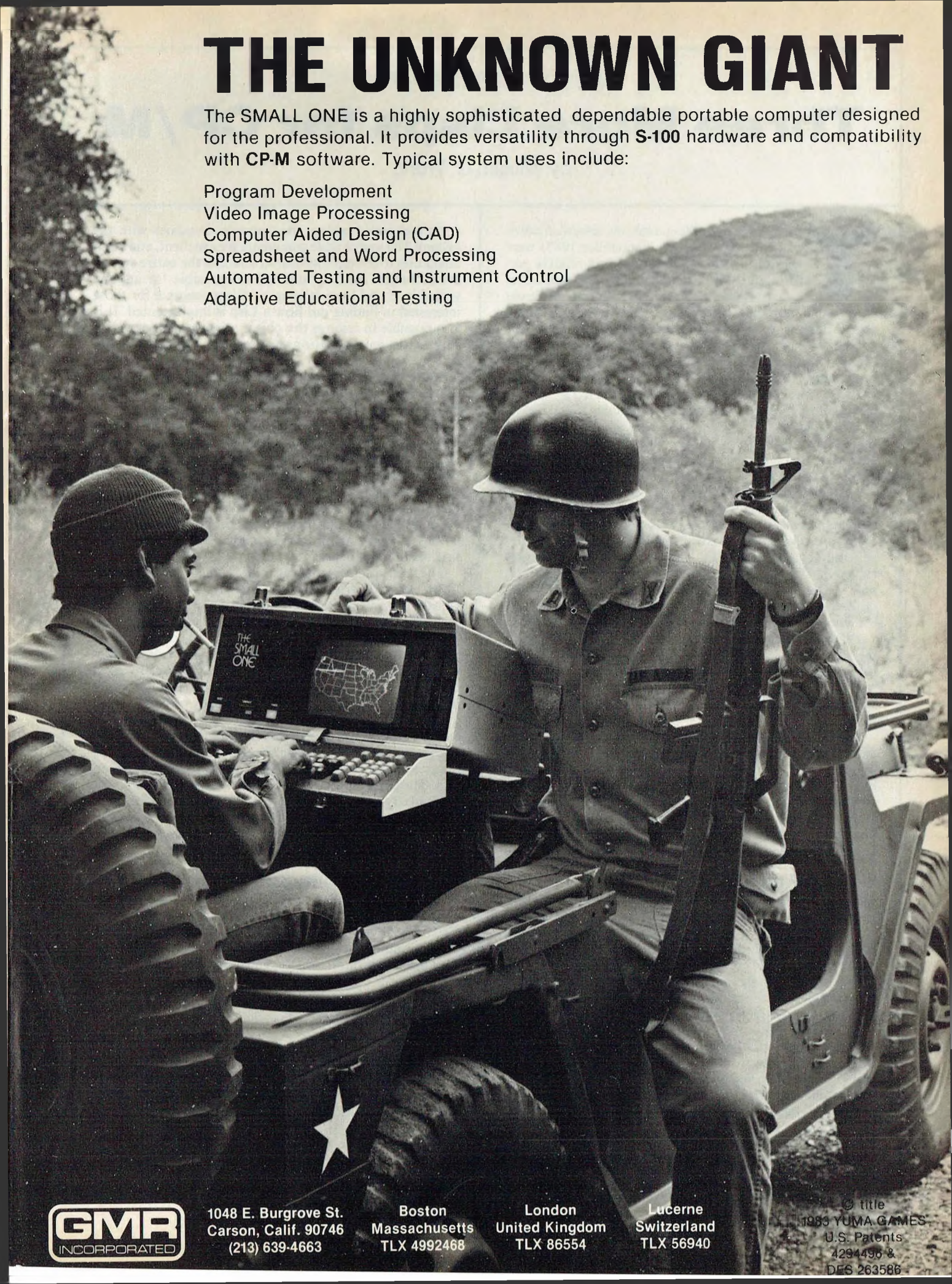

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Three More Lisps for CP/M

by William G. Wong

The three Lisp implementations reviewed previously in *Microsystems* (September 1983) were similar to each other in price and relative performance. Three more implementations are reviewed here, but these are distinctly different in price, performance, and purpose. The first is XLISP by David Betz, who has placed it in the public domain. The source code is available from Special Interest Group for Microcomputers (SIG/M) for $5; it is also available free from many RCPM systems. The second is LISP/80 by Walt Bilofsky of The Software Toolworks. At $39.95, it is one of many pieces of quality software under $50. The last is TLC Lisp by John Allen of The Lisp Company. The price of version 1.10 is $150. They are all excellent pieces of software. First, a few general comments on each implementation.

XLISP is an object-oriented system very similar to Smalltalk-80 from Xerox and the Lisp-machine Flavors system from MIT. XLISP was written to study object-oriented programming, because Smalltalk systems are not generally available. XLISP is written in C and currently runs on a PDP-11 under RSX-11, RT-11 and UNIX V7, on a VAX-11 under VAX/VMS and Berkeley UNIX, and on Z80 systems under CP/M-80. To run it under CP/M-80, compile the source code using the Aztec C Compiler.

LISP/80 can run on either an 8080 or a Z80, and multiple copies are available for minimal cost; this makes it ideal for schools and universities. It is a very complete system with excellent documentation. This system should be used as a model for other vendors providing low-cost quality software.

TLC Lisp V1.10 has been available since 1980 directly from The Lisp Company. It has many features, such as macros and floating-point numbers, that are normally found only on mainframe implementations of Lisp. New versions of Lisp and Logo (a popular graphics language based on Lisp) will be available soon for both CP/M-80 and the IBM PC. The new Lisp implementation will be tested when it is released.

Documentation

The XLISP documentation is well written and is provided as a CP/M text file, so modifications are easy. The manual is short and well organized, but lacks a table of contents, index, and bibliography. The document is a bit terse, and requires a good knowledge of Lisp and object-oriented program languages to figure out what is going on. I would recommend getting the book on Smalltalk-80 from Addison-Wesley for more information.

The XLISP documentation fails to mention that the keyboard input can be uppercase or lowercase and that "Class" is different from "CLASS" or "class." This can be a little confusing when using the predefined names. An option not mentioned is that the name of the initial file to load can be included as the initial parameter.

William G. Wong, 902B Merritt Drive, Somerville, NJ 08876

As mentioned before, the source code comes with the system! The source code comments are excellent, and command files to compile, assemble, and link the entire system are included. Adding functions is possible for anyone versed in C and Lisp. It is an excellent example for those interested in finding out how a Lisp is implemented. It is also possible to remove the object-oriented programming support to gain additional space, leaving a Lisp-only system.

The LISP/80 documentation is excellent, especially for the price. It is well organized and professionally printed. Users should demand quality documentation like this from all vendors. The manual is only 35 pages long, but is very well organized and includes a table of contents, index and an annotated bibliography. It has a good preface, which describes backup procedures. The following pages contain a description of all supplied files, a description of Lisp, instructions on how to run LISP/80, and a detailed list of all the functions. This document is a prime example of how a large amount of information can be placed on a small amount of paper.

The license agreement is also worth mentioning, primarily because of its friendliness and policy. Although it is obviously mass produced for distribution, it has a personal touch that is a pleasant surprise. You will not mind signing this agreement.

TLC Lisp comes with a fairly substantial document that is being updated for the new software release, so most deficiences mentioned are being corrected. The document is divided into three sections: the first deals with the esoteric aspects of Lisp, the second addresses some practical examples, and the third describes this implementation; however, it does not always describe the purpose or operation of some functions in enough detail or with sufficient examples. The parts on stream I/O and the autoload option are particularly deficient in this respect. The document has a table of contents and a bibliography. Indices are provided, but there is a separate index for each section, which sometimes makes it difficult to find what you want.

Lisp compatibility and enhancement

XLISP is very similar to MacLisp, which is a dialect of Lisp from MIT. It uses the single-quote shorthand, so (QUOTE A) can be written as 'A. User input is made easier by printing (before each prompt) the number of unmatched left parantheses, as shown below.

```
> (defun example
1) (x y z)
1) (cond ((> x y) z)
2)       ((= x y) y)
2)       ((t x )))
```

One inconsistency exists between MacLisp and XLISP IF function implementations. The conditional expressions in MacLisp are single expressions; XLISP, on the other hand, requires a list of expressions as shown below.

```
MacLisp: (if condition (print 'true)
         (print 'false)))
XLISP:   (if condition ((print 'true)))
         ((print 'false)))
```

The primary enhancement in XLISP is its support for message-passing objects. The following is a brief explanation of this type of system and how it operates in XLISP. In Lisp, functions are applied to data items such as atoms and lists. These items can model objects such as boats, cars, and trains. For example, a list describing a car could include information such as its location, direction, speed, occupants, and so on. Changing the direction of a car might be done by a function called CHANGE_A_CARS_DIRECTION. A different function would be used for trains, because trains differ from cars (e.g., trains run on tracks). Obviously, the number of functions needed to change the direction of an object grows in proportion to the number of different objects. It also does not exploit any commonality that may exist.

XLISP addresses the problem with the object-oriented programming style, using the idea of message passing. XLISP has an object instead of a function as the first element of an expression. The rest of the list is sent as a "message" to the object, which is similar to the way parameters are passed in Lisp. The difference is that the "message" contains the type of operation to be performed. An object actually contains local information called "instance variables" and a set of "methods" that can change this information. The methods of an object each have an associated name that corresponds to the first parameter of a message. An XLISP method is just a list of expressions.

XLISP and most message-passing systems, such as Smalltalk, provide the mechanism for invoking the appropriate method. This is similar to the SELECTQ function mentioned before, but the selection is based on the method name instead of the object type. A simple implementation would lead to a problem similar to that encountered by the functional approach, because sharing methods would be difficult. XLISP solves this by having a class structure with inheritance properties.

In this environment, each object is part of a class (also an object) which contains the methods. For example, assume BOAT is a class where BOAT_0 and BOAT_1 are "instances" of BOAT. BOAT_0 and BOAT_1 have "instance variables," while BOAT has the methods for manipulating these variables, thereby allowing BOAT_0 and BOAT_1 to share methods. Common information is saved in "class variables" that are part of BOAT. This leads to the structure shown in Figure 1, in which DIRECTION is an instance variable associated with each instance of BOAT. These values can be changed independently of each other. Changing the direction of a boat is done by the method in BOAT.

Actually, the class structure is a hierarchy, so BOAT has a class above it. Any message received by an object is processed by the first method which has the matching name in the lowest associated class. For example, the message CHANGE_DIRECTION sent to BOAT_0 is handled by the object BOAT; any other message is handled by a higher class. An error occurs if a method cannot be found.

The class relationship shown in Figure 2 shows how this inheritance scheme works. In this case, the MOVABLE_OBJECT class has the method for changing direction which is inherited by the lower classes. A CHANGE_DIRECTION message sent to BOAT_0 now uses the method in the MOVABLE_OBJECT.

This structure uses only one version of CHANGE_DIRECTION. It also means that the same message can be sent to the different objects to perform the same logical function. Alternate methods can be added at lower levels to customize on operation. For example, the TRAIN class could have a different method associated with CHANGE_DIRECTION. In this case, the method associated with MOVABLE_OBJECTS is not used by TRAIN-type objects.

The class hierarchy has a upper limit in XLISP: the top item is called "Class." "Object" is at the top of the object hierarchy, which includes Class. A class below another class in the hierarchy is called a "subclass;" a class above another class is called a "superclass." "Class" is the only object which is a subclass and superclass of itself. "Class" and "Object" have a number of built-in methods, including the following messages.

Name	Description
new	Creates a new instance of a class object
isnew	Initializes a new instance
answer	Adds a new method to a class
ivars	Defines a set of instance variables
cvars	Defines a set of class variables

Since all new classes are a subclass of Class, they will all respond to these messages unless they are defined at a lower-level boat class. New classes can be enhanced by adding instance and class variables, along with methods. Complete descriptions of the messages for objects, classes, and so on are contained in the XLISP documentation. XLISP provides the basic class and object support for object-oriented, message-driven programming. Although this new style of programming is very powerful, the other Lisp implementations should not be overlooked; they provide many options which XLISP does not.

LISP/80 is patterned after Interlisp, which is a well-known and very powerful implementation of Lisp. This compatibility offers a nice growth for any work done under CP/M, assuming that a larger Interlisp system is available. Lisp/80 provides a READ-EVAL-QUOTE user interface which differs from the normal READ-EVAL-PRINT interface used by the Lisp systems reviewed. The difference is the EVALQUOTE function which makes the following

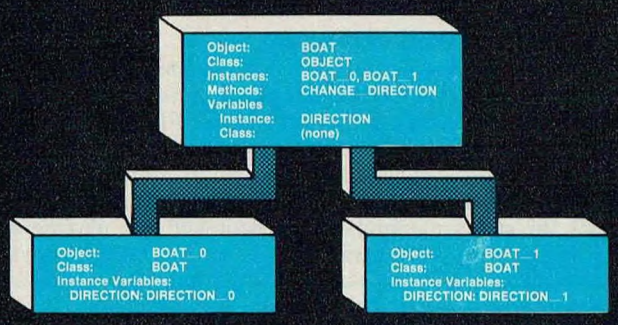


Figure 1.

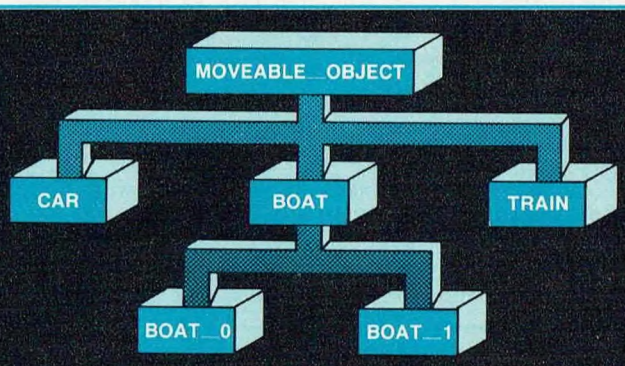


Figure 2.

two entries the same:

```
READ-EVALQUOTE-PRINT: SET (A (1 2 3))
READ-EVAL-PRINT: (SET (QUOTE A) (QUOTE (1 2 3)))
```

The first method reads two elements, SET and (A (1 2 3)), while the second reads only one element. The second also requires two applications of the QUOTE function to get the same effect. The interesting thing about EVALQUOTE is that it will also accept the second example and give the same result because the first entry is a list. This means that the EVALQUOTE method supersedes the plain EVAL method. Actually, the READ-EVAL-PRINT loop is used in most implementations because it is more consistent. Also, using the quote shorthand, included in LISP/80, simplifies the previous example to (SET 'A' (1 2 3) making the EVALQUOTE unnecessary. LISP/80 also includes the superbracket enhancement which allows a square bracket to match any number of normal parentheses; thus, the following two expressions are functionally identical:

```
Normal: (1 (((2) 3) 4) (5 (6 (7 8) (9 10
        (11 12)))))
Superbracket: (1 (((2) 3) 4) (5 (6 (7 8)
        (9 10 (11 12]
```

TLC Lisp is related to another well-known dialect of Lisp called MacLisp, and a cousin named UCI Lisp. It, too, provides the quote shorthand but through a more flexible system called "read macros." A read macro is a function definition associated with a character. This function is called each time the character is read using the normal input functions. The result of the function is used instead of the character. The quote shorthand is implemented by reading the next item and returning a list which contains QUOTE plus the item. The function is installed with the following expression.

```
(DMC \' () (LIST (QUOTE QUOTE) (READ)))
```

The backslash (\) preceding the quote (') is used because the quote character is considered a special character and the backslash indicates that the next character is read without special interpretation. In fact, the backslash is also a built-in read macro definition. Read macros are very powerful and can be used to implement many useful functions, including comments that are automatically eliminated when loaded, thereby preserving scarce memory resources. TLC Lisp uses the semicolon (;) for comments.

TLC Lisp also includes generalized MACROs which are like assembly language macros that are expanded before being evaluated. Although Lisp FLAMBDA functions do not evaluate their arguments, evaluation is done in the context of the definition. Consider the following two definitions.

```
FLAMBDA: (DF TEST_F (X) (EVAL (FIRST X)))
MACRO: (DM TEST _M(X) (FIRST (REST X)))
```

The first definition takes the first parameter in the list and evaluates it. The MACRO definition does not evaluate its arguments either, but the parameter variable is bound to the list being evaluated. In this case X would be bound to a list containing TEST_M plus the rest of the parameters in the list. The result of TEST_M would be the first element of the parameter list. The difference is that this result is then evaluated in the context from which TEST_M is called, so MACROs have an implicit EVAL associated with them. The following examples should clear up any confusion. Assume that global X is equal to 1 and that global Y is 2.

Expression	Prints	Result
(TEST F_(PRINT X))	((PRINT X))	((PRINT X))
(TEST F_(PRINT Y))	2	2
(TEST M_(PRINT X))	1	1
(TEST M_(PRINT Y))	2	2

Note the different result for the first expression. This occurs because X is a both local variable to TEST_F and a global variable. The dynamic scoping for variable access in Lisp causes the local variable to take precedence. The second expression works as expected because Y is not a local variable. Using MACROs eliminates any confusion.

The normal TLC Lisp definitions are also enhanced with the MacLisp syntax for additional local variables. The parameter list of a definition can optionally include any of the atoms &OPTIONAL, &REST, &AUX, in that order. These are not variable names but indicators that must be followed by variable names. The binding of actual parameters to logical parameters is done by first binding actual parameters to logical parameters that precede &OPTIONAL; further actual parameters are then bound to elements that follow &OPTIONAL; if any parameters remain, they are bound to the single variable after &REST. The number of actual parameters must match the form of the logical parameters with these optional controls, otherwise an error occurs. Variables after &AUX are set if no error occurs.

These features allow functions that support any number of parameters, including optional items. They also eliminate both the need for the PROG function (which is typically used to define local variables) and the need to have a number of conditional assignments for initializing variables. There is really no limit to the flexibility of a function when MACROs, &OPTIONAL, &REST, and &AUX are available.

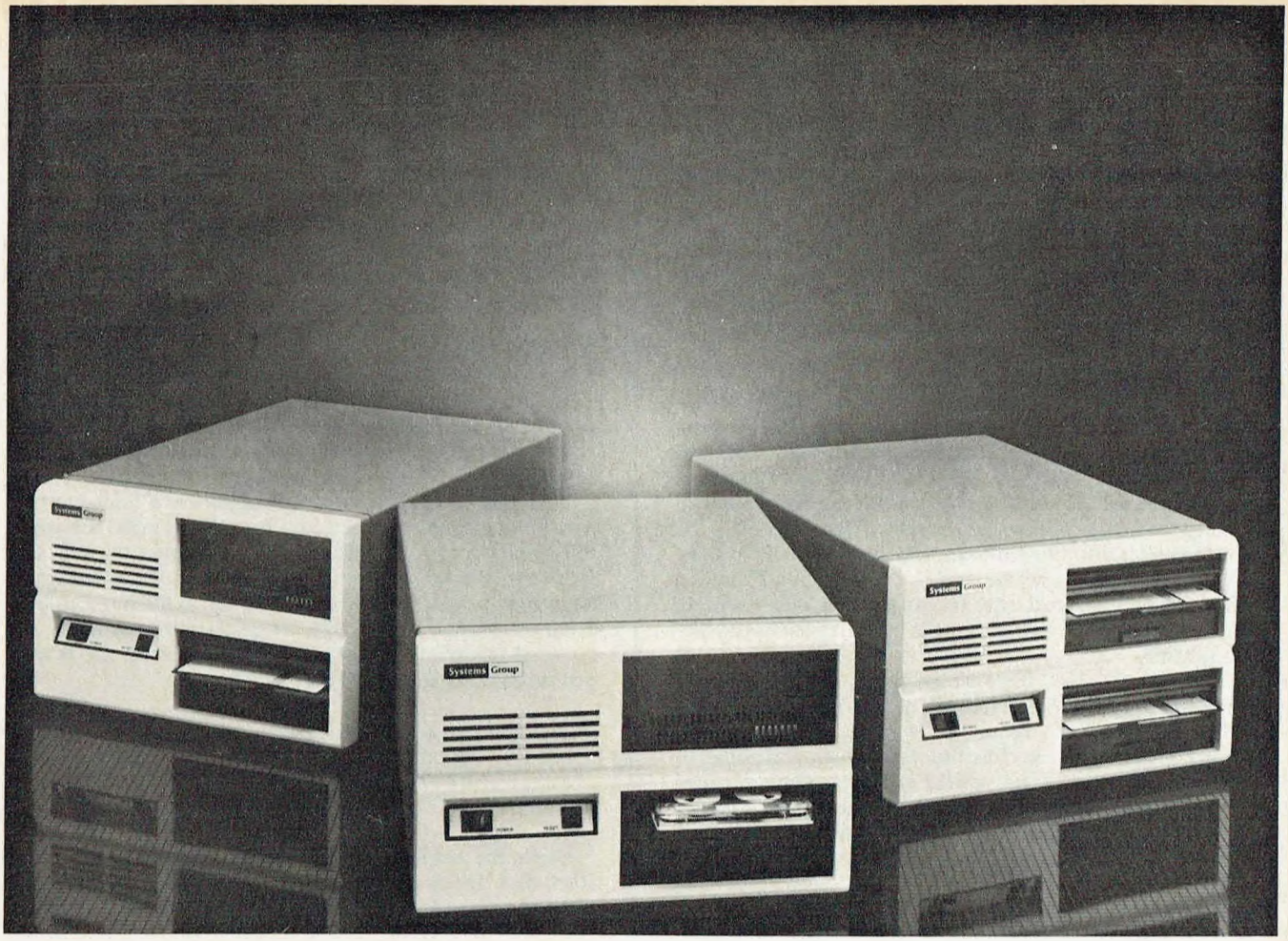
TLC Lisp is packed with more features than can be listed here, but there is one more that is worth noting. This is the additional datatype called a vector. A vector has a fixed size that cannot be changed, and the normal list operators like CONS do not work with vectors. Special functions are used to access and update elements. In this version of TLC, vectors are limited to 256 elements. Using vectors instead of lists cuts the amount of space in half because CONS cells are four bytes and vector cells are two bytes.

Numbers and strings

XLISP supports only 16-bit integers and strings, even though the Aztec C compiler (used to compile XLISP) supports floating-point numbers. Floating-point arithmetic was omitted to save space, although it could be added. Strings can be as large as memory allows.

LISP/80 also supports only 16-bit integers and strings, but the string manipulation is poor and the maximum string length is 127 characters. The strings cannot be ma-

TLC Lisp is related to a well-known dialect of Lisp called MacLisp, and a cousin named UCI Lisp.



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nipulated directly except for conversion between lists of single characters and strings.

TLC Lisp is the *only* one that supports floating-point numbers as well as 16-bit integers. The arithmetic functions even handle mixed-mode arithmetic. The string support is also very good; it includes substring extraction and replacement and strings up to 256 characters in length.

I/O support

XLISP supports only multiple sequential text files, although random-access operation could be added. Also, XLISP has only a program-load facility; program generation is therefore usually done on CP/M text files, using a word processor. There is no pretty-print facility or built-in facility to save definitions generated while in XLISP.

LISP-80 is also limited to multiple sequential text files. The pretty printer is written in Lisp, and is slow. There is a very nice text file load/save feature, which keeps a list of functions loaded from a file on the property list of the filename atom.

TLC Lisp V1.10 is likewise limited to multiple sequential text files. The file system is generalized into objects called "streams." A stream can be fed by a string, a function, a device, or a file. The function which is reading or writing to a stream cannot tell the difference. This can lead to some very flexible programs. TLC Lisp also includes a save/restore function that saves/restores all working memory on a file—much faster than using the text files.

Resident Lisp editors

XLISP and **TLC Lisp** do not have any sort of resident editors. **LISP/80** has a list editor written in Lisp. It is small, providing minimal functionality, but is sufficient for most applications.

Error handling

XLISP has no error handling except a display of the current state of the execution along with the error message. This can actually be very handy in debugging, although errors during very deeply nested function calls can yield a large number of display lines, which could exceed the normal 24 lines on a CRT display. In this case some of the information may be lost, because it scrolls off the screen.

LISP/80 is similar to XLISP in this area; however, it has a break mode that is entered by calling the BREAK function, typing control-B, or encountering an error when the value of the BREAK is not NIL. The break mode prompts the user with a colon (:) and operation is similar to the Lisp top level. Functions and variables can be viewed and altered and the current evaluation state can be examined. Continuation is possible but only from the point where the error occurred.

LISP/80 has a trace facility. It is built in, so enhancements cannot be made from Lisp. There is no overhead if the facility is not used, but activation of the trace option incurs a small overhead for each function call. The parameters of a traced function are printed upon entry, and the result upon exit.

TLC Lisp has both the trace and break functions, along with the more generalized CATCH and THROW functions. The trace and break functions could be replaced by user-supplied functions. The next version of TLC Lisp is supposed to have even more enhancements in this area patterned after Interlisp.

Autoloading

Autoloading is a feature that allows seldom-used functions to be stored on disk files. This considerably reduces the amount of space used by a program. **XLISP** and **LISP/80** do not have this as a built-in option, though it could be added.

TLC Lisp does have autoload support as a built-in option, but it cannot be enhanced. Three things make this implementation unique: first, it can load values as well as functions; second, random file access is used so multiple items may be stored in one file; and third, loading can be done only once (SMASH), or every time an item is accessed (NO-SMASH). Creating an autoload file is as easy as entering the following expression.

```
(MKAUTO "A:EXAMPLE"
        '((FUNCTION_0 . SMASH)
          (FUNCTION_1 . SMASH)
          (FUNCTION_2 . NO-SMASH)))
```

Using the autoload feature from floppy disks is slow. Hard disk drives are faster; a memory disk is best of all. NO-SMASH works best with a memory disk.

Garbage collectors and working space

The garbage collectors and work space of a Lisp system are usually invisible to the user, but they can affect response time. **XLISP** is the slowest, taking as long as three seconds to complete. The workspace is only about 2K CONS cells, due to the large (6-byte) CONS cell size.

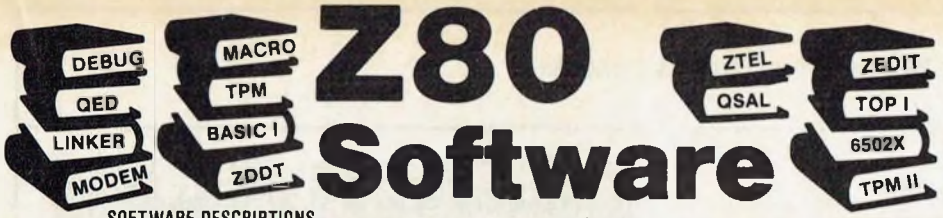
LISP/80 offers a faster garbage collect, smaller CONS cells (4 bytes each) and more working area. Garbage collection takes less than one second for approximately 3K characters and 6K CONS cells, which is a respectable number.

TLC Lisp also has a fast garbage collector but lacks any statistical information on available memory. Empirical estimates indicate about 5K CONS cells or 20K. Strings and vectors are also allocated from this space.

Assembly language interface

XLISP offers the best language interface option because it is written in C. Modifications can easily be made in either C or assembler and simply linked in, because source code is included. Source code is not included with **LISP/80**, but the documentation does show how assembly language functions can be added to the system. The documentation even includes a very clear example of how to add an assembly-language-defined Lisp function. **TLC Lisp** version 1.10 does not at present include any information on an assembly-level interface.

Lisp is one of the few languages that can be extended in a clean and systematic fashion by the user: it is no longer restricted to use on large mainframes.



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VALUE: $1250 **NOW $325**

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Performance

Performance is always relative, and the function being performed must be taken into account. **XLISP** is one of those programs which must be looked at very carefully. For Lisp operations, it is slower than any of the other Lisps reviewed here; but it is somewhat faster when using the object-oriented support.

LISP/80 and **TLC Lisp** are much faster in those areas where XLISP falters. Arithmetic and string manipulation are on par with most Basic or Pascal implementations. List manipulation give Lisp a performance edge in symbolic applications and TLC Lisp vectors help when solving array-oriented numeric problems.

Summary

The three Lisps covered in this article offer a broad spectrum of choices for those wishing to use and learn Lisp. **XLISP** offers Lisp and object-oriented programming at almost no cost. Complete source code in a high-level language like C makes it a prize any computer science student would envy. It could be implemented on a 16-bit processor, using existing C compilers, resulting in better performance and an increased workspace.

LISP/80 is a fantastic buy at only $39.95, and is probably the best option for anyone interested in learning Lisp. The speed is reasonable and the number of built-in Lisp functions is substantial. The sequential file subsystem can be used to build file-based applications.

TLC Lisp looks like one of the best Lisp implementations to hit the street. It is very complete, and rivals implementations on larger computers with regard to functionality and completeness. Version 2 of TLC Lisp, currently under development, will correct many deficiencies noted here for version 1.10 and will have many enhancements. We hope to review it when it is released, and it should prove to be very exciting.

Stiff Upper Lisp and **muLisp-80** (reviewed September 1093) compare well with LISP/80 and come close to TLC Lisp. **Supersoft Lisp** comes in after XLISP. Having six implementations to choose from is definitely an advantage.

Lisp is one of the few languages that can be extended in a clean and systematic fashion by the user. It is no longer restricted to computer scientists using large mainframes. CP/M made the microcomputer a viable alternative to minicomputers and mainframes, and these implementations make Lisp a viable alternative to Basic and Pascal. Cost and availability are no longer restrictions on using Lisp, so try it! You'll like it.

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Allen, John: *TLC Lisp Reference Manual.* The Lisp Company, Redwood Estates, CA: 1980.

Betz, David: *XLISP Reference Manual* (supplied on disk with XLISP): 1983.

Bilofsky, Walt: *Lisp-80 Reference Manual.* The Software Toolworks, 15233 Ventura Blvd., Suite 1118, Sherman Oaks, CA 91403: 1982

Goldberg, Adele, and Robson, David: *Smalltalk-80: The Implementation.* Addision-Wesley, New York: 1983.

Teitelman, Warren: *Interlisp Reference Manual.* Xerox Palo Alto Research Center, Palo Alto, CA: 1978.

Weinreb, Daniel, and Moon, David: *Lisp Machine Manual.* MIT Press, Boston: 1981.

David Betz, author of XLISP, comments:

First, I'd like to thank Bill Wong for considering my interpreter for his review. I have only two minor comments on the information he provided. In the beginning of the review he states that:

> *"To run it [XLISP] under CP/M-80, compile the source code using the Aztec C Compiler."*

While it is true that all of the source code for XLISP is included in the distribution, it is also true that an executable image for CP/M is also included. It is compiled for the Z80 and will work only with systems that have at least 64K of memory. The point is that you don't necessarily need to buy the Aztec C compiler in order to run XLISP!

The other point that I would like to clarify is his statement that:

> *"It [XLISP] is an excellent example for those interested in finding out how a Lisp is implemented.*

Since source code is provided with XLISP, it is indeed possible to find out how it is implemented, but I would like to point out that XLISP is not a traditional implementation of Lisp. Its evaluator is different because of the need to support message passing to objects, and its structure is much simpler than any more traditional Lisp implementation. This is a result of the original goal that I had in writing XLISP in the first place. I wanted to experiment with object-oriented programming, and it is easy to extend a simple implementation of Lisp to support message passing. XLISP is intended to be a language for experimenting with object-oriented programming and only secondarily a simple Lisp implementation.

Any questions about XLISP can be directed to me at:

David Betz
114 Davenport Ave.
Manchester, NH 03103
(603) 625-4691

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XLISP — **Price:** $5 + $1 shipping; $6 + $3 int'l
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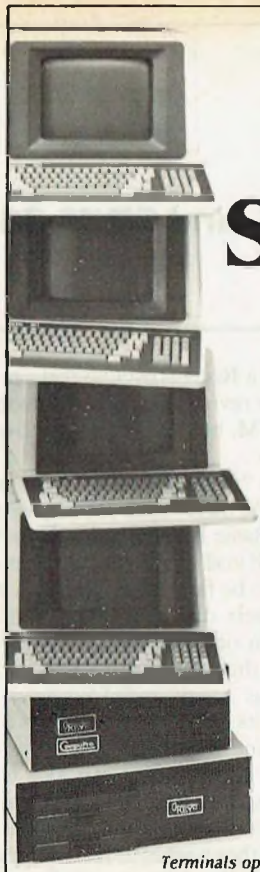

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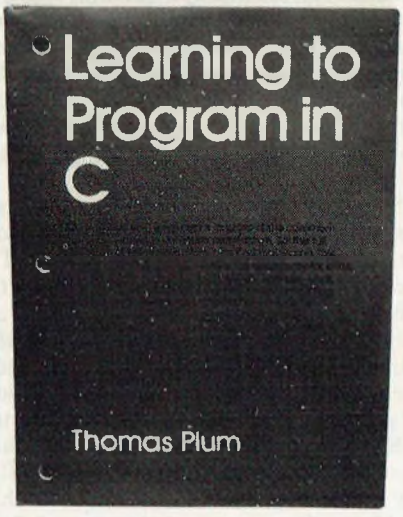

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MICROSYSTEMS REVIEWS

APCBASIC

A North Star compatible Basic for DOS, CP/M, MS-DOS, and CP/M-86

by Robert J. Stek

Despite the fact that North Star Basic (NSBasic) was originally meant to be used only on computers with North Star's S-100 disk controller and North Star's own DOS, it has proved very durable. Much of its popularity is no doubt due to its low cost (it's free when you buy a North Star disk system), but a convincing argument could be made on the basis of its fine features, which were (and still are) lacking in Microsoft's MBasic. Multiline user-defined functions provide more power and convenience than the restrictive single-line functions of MBasic. With binary-coded decimal arithmetic, so-called "round off" errors are never a problem. If you need more (or less) precision, BCD versions with 6, 10, 12, or 14 digits of precision are also available. If you need speed, an optional S-100 floating-point math board is available. The ability to read and write files at the byte level can also come in handy. And while string arrays are not directly implemented, a one-dimensional string can be 64K long! NSBasic has found favor with tens of thousands of programmers, since programs could be developed interactively with NSBasic and then compiled to true machine code with Allen Ashley's COMSTAR compiler.

But while North Star continues to supply their own DOS and Basic with both their Horizon and the Advantage, everyone realizes that we currently live in a CP/M world. And soon, that may become an MS-DOS world (or UNIX or CP/M-86 or whatever). Like many others, I learned to live with MBasic under CP/M. It is true that it has many good features not found in NSBasic, but I missed the capabilities of NSBasic. Infosoft Systems in Connecticut offered a very nice patch to run NSBasic under CP/M, as did the SoHo Group in New York City. And a public domain version of a similar patch is still available from CPMUG. Micro Mike's of Amarillo, Texas offers baZic, a Z80-only version, that can run under either DOS or CP/M; it is 20 to 40% faster than NSBasic and 100% compatible. So if you are willing to part with a few dollars, you can use NSBasic under CP/M.

Unfortunately for NSBasic programmers under CP/M, not one of the above solutions is totally adequate. Infosoft's system does not allow you to use the floating-point board or different precisions. SoHo's system does not allow you to save programs in ASCII. And none of them significantly improves upon the NSBasic features that North Star originally offered.

Fortunately at least one company has seen fit to make a significant effort to ensure the survival (and perhaps even ascendance) of a North Star compatible Basic under CP/M, CP/M-86, and MS-DOS. American Planning Corporation has been advertising APCBASIC as the "Rolls Royce" of Basics. After "touring" APCBASIC with me on this review, you may come to appreciate some if its finer points. APCBASIC may not be a Rolls Royce, but it certainly is a Mercedes-Benz! This review examines version 2.4.2 of APCBASIC under CP/M, but the review applies to the other versions as well.

Many programmers develop a "wish list" of features for a particular language. In the "old days" (pre-1979) when RAM was still at a premium, Basic language developers tried to keep the interpreter small and therefore did not incorporate many new features. To be fair, Microsoft added many features, but only in their disk-based version. APCBASIC has gone at least an order of magnitude beyond anyone else with features that are of great value to systems developers who want as many useful programming conveniences and features as can be reasonably provided in a language (see box). And they do it in an interpreter that is only 20K in size. APCBASIC can also be appreciated by the "average" Basic programmer, who may be running into some of the limitations of Basic as a programming language, but who neither wishes to learn a new language such as Pascal, C, or PL/I, nor wants to give up the convenience of an interpreted language.

A list of the advantages of APCBASIC could go on and on. But just listing the new features does not convey the flavor of the many "little" things that have been improved as well. For example, the SAVE command responds with an OLD or NEW FILE message and requests Y/N confirmation; and if you have previously SAVEd a copy of your program, just using SAVE without the filename will store your latest version over the top of your last effort, making program backup during development fast, repeatable, and mistake-proof. The EDIT command has been improved with selective EDITs possible: EDIT 100, PRINT A allows sequential EDITs of all lines after line # 100 that contain PRINT A; indeed, the search string may even contain "wild card" characters represented by a question mark (?). The DELete command has been improved so that it will work even if nonexistent line numbers are given; it will use the nearest existing line numbers instead. Admittedly this is a small improvement, but it does diminish one of the common frustrations experienced by many people during the intense concentration required for program development.

And APCBASIC appears to be about 98% upward-compatible from NSBasic. There are some differences which are detailed in a special section in the manual. The most noticeable changes are very minor ones; some of the keywords have been either changed or alternatively defined. AUTO may be used, but the preferred command is ENTER or just ENT; CHAIN works but LINK does too; NOMARK is used as well as NOENDMARK. This does not mean that any changes would have to be made in running existing NSBasic programs; the tokens used internally are the same but will list differently under APCBASIC. The only other difference I encountered was that APCBASIC would not allow two single-line user-defined functions on a single program line—they had to be placed on two separate lines.

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Performance

All these great features would matter not a whit if APCBASIC offered poorer performance than what is already available. Since it does require a Z80 processor, it might be expected that judicious use of the Z80's expanded instruction set could help its performance over that of the 8080 code of NSBasic. But according to the benchmark testing I did, it is obvious that the author of APCBASIC has a few other tricks up his sleeve as well. APCBASIC is significantly faster than NSBasic and baZic on all benchmark tests I performed (see Table 1). For example, I obtained the following times on three programs: (1) a quicksort of 1,000 random numbers, (2) a chi-square test for randomness of 1,000 random numbers, and (3) a version of the PRIMES program documented in *Byte* magazine (January 1983). Values for MBasic on the chi-square and PRIMES program are included for comparison.

Table 1. Benchmark times (in seconds)

Program	NSBasic	baZic	APCBasic	APCRUN	MBasic
Quicksort	193	121	86	65	N/A
Chi-square	138	91	67	57	76
PRIMES	147	115	101	76	115

A further note of explanation is needed regarding the APCRUN heading. APCRUN is a special "runtime" version of APCBASIC furnished with the standard version. It is not used for development work since it lacks the interactive editing commands. It provides about 3.6K more free memory, automatically deletes all REM statements and extra blanks from the program, and runs up to 50% faster than the normal APCBASIC (depending, of course, on the program). It is apparent from the chart that for a "real-life" task (the quicksort), APCBASIC can be three times faster than NSBasic running under CP/M—certainly significant enough an improvement to make one consider the use of APCBASIC for many applications. The runtime version also gives the professional program developer some security in the protection of source code, since programs are stored in tokenized and compressed form.

Ease of use

As noted, APCBASIC has provided thoughtful extensions to the standard commands with which NSBasic users are already familiar. All these "nice" features become second nature quite quickly, and you find yourself annoyed that they are not features of other languages. Those concerned with structured programming will find local variables within subroutines and functions, as well as the WHILE construct, of great comfort. The addition of a global search and replace command will be welcomed by everyone. The CHANGE command replaces one string with another everywhere or selectively within a range of line numbers. CHANGE will also request a response to its VERIFY? prompt to allow you to control each replacement as found.

The facilities for debugging programs are extended as well. The TRACE command allows single stepping through a program one line at a time, skipping detailed tracing of loops or subroutines if you wish, and stopping program execution temporarily to allow for examination (or changing) of variable values before continuing. The TRACE may also be executed conditionally (e.g., 99 TRACE IF A > 50). This allows you to determine dynamically how and where erroneous values originate. Finally, TRACE allows you to direct its output to your LST: device rather than the console if you so wish. A control-C interrupt allows for direct execution of any executable program statement or line of statements (without exceeding its 159-character line limitation). For example, the contents of an entire array may be examined by entering a single-line FOR . . . NEXT loop in the direct mode. And any alterations you make to the contents of a program variable will be carried over if you CONTinue execution.

Some features of APCBASIC

1. Faster operation—two or three times faster than NSBasic in many cases.
2. Ability to save or load programs as standard ASCII files.
3. A global search and replace command for editing
4. A sophisticated TRACE command, including conditional tracing.
5. The ability to redimension arrays under program control.
6. The ability to use the built-in line editor under program control.
7. More flexible substring handling and extended string indexing.
8. A RENumber command that supports rearrangement of entire groups of lines, as well as "simple" renumbering.
9. Extended format specifications for PRINT formatting.
10. The ability to PRINT anything to the console, to the list device, or to an ASCII text file just by varying the output device number (a form of I/O redirection).
11. A SWAP statement, an ON (expression) RESTORE (line # list) statement, new functions such as CEIL(X), TRUNC(X), MOD(X), FRAC(X), MIN(X,Y, . .), MAX (X,Y, . .), a polynomial evaluation function, a TRIM$ (S$) function to remove leading and trailing blanks, substring FIND and MATCH functions, BIT manipulation functions, a RENAME command, a SPACE(X) function to return the amount of remaining disk space, and an extended machine language CALL statement.
12. A WHILE loop construct.
13. LOCAL variables within GOSUBs and FNs.
14. Almost all commands are executable, including DELete and MERGE.
15. Variable passing between CHAINed programs.
16. Compound statements executed as a group within IF statements; e.g.:

```
IF X=Y THEN [ R=SQRT(Z+10)\SWAP S,T ](1f)
       ELSE [ WHILE I<10\R=R+X(I)\NEXT ]
```

17. Multiple ranges within a FOR . . . NEXT loop (e.g., FOR I = 1 TO 10, 20 TO 100, 200 TO 1000.
18. A file may be opened under more than one file number, allowing for extended buffering, significantly increasing the speed of some file-bound applications, since APCBASIC will check its buffers before accessing the disk.

APCBASIC provides thoughtful extensions to the standard commands that NSBasic users are familiar with. These features soon become second nature, and you find yourself wishing they belonged to other languages.

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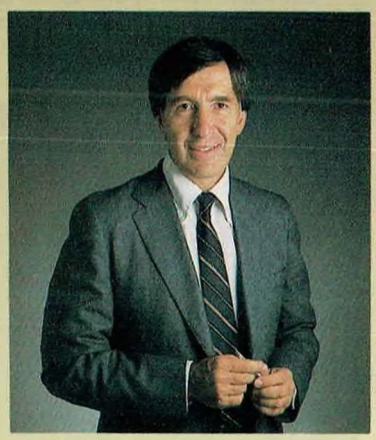

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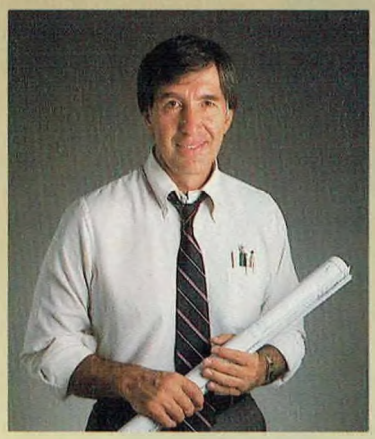

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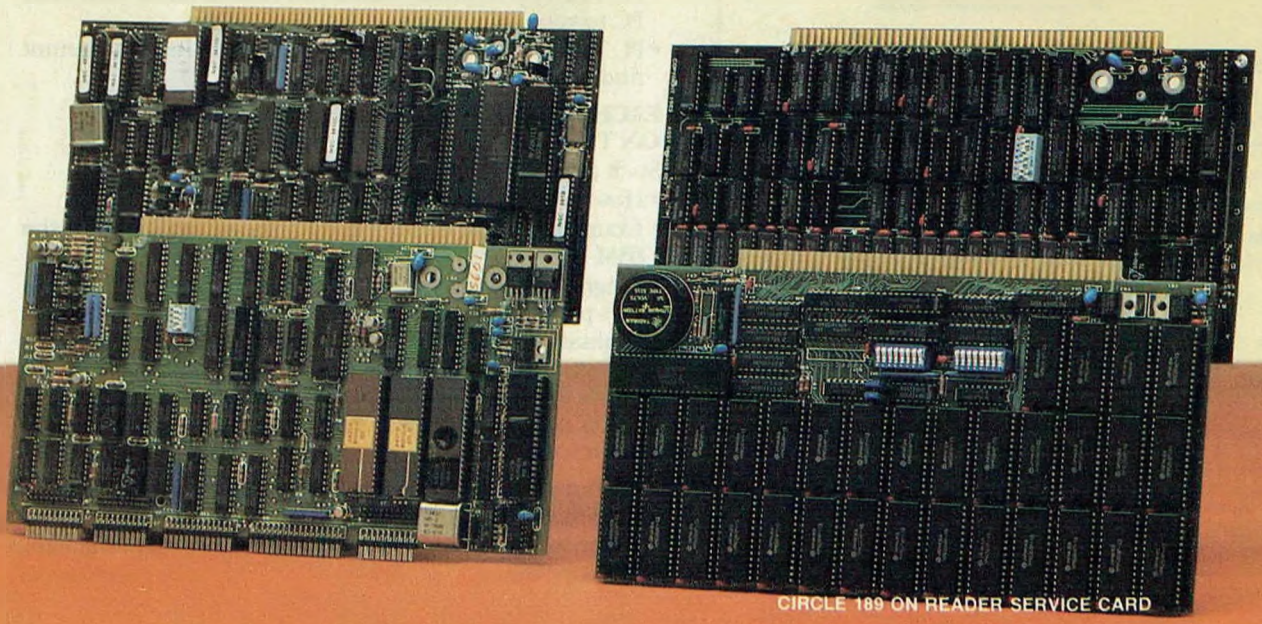

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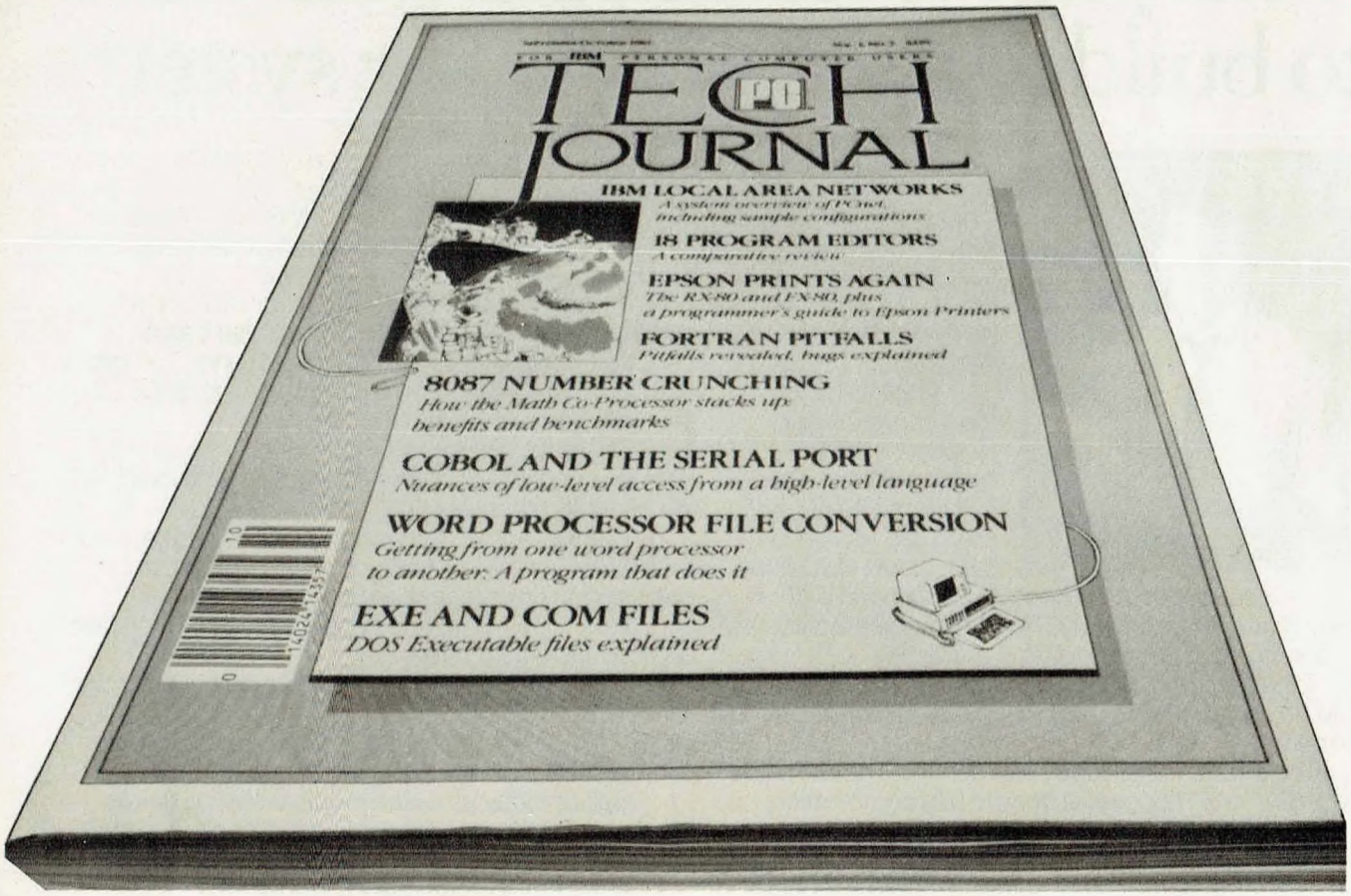
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Three utility programs are provided with APCBASIC: ZBIG, CRUNCH, and CONFIG. ZBIG is a machine language cross-reference index generator for APCBASIC programs. It provides an alphabetized instant directory to all user-defined functions, GOSUBs, variables, GOTOs, and other line referencing used in a Basic program. CRUNCH performs some simple optimization of a program by creating a new version without blanks and REMarks and by concatenating multiple lines into one line where possible. The latest version of CRUNCH also has an option to "scramble" your program so that it cannot be LISTed or LOADed by even the normal development version of APCBASIC. CONFIG personalizes APCBASIC in regard to floating-point board address (if used), console backspace sequence, system interrupt flag, and control-C detection flag.

Also provided is a library of subroutines that can be merged into your own programs. These routines include matrix multiplication and inversion, a numeric quicksort and a string quicksort, a hybrid bubble sort, date functions, many math functions, and a whole lot more. The library source file is about 30K long and is extremely well documented. It does provide additional insights into the use of some of the newer features, though it is mostly a practical addition to your own subroutine library.

One last utility is also available for users who wish to convert NSBasic programs currently residing on a North Star DOS disk. This program allows you to transfer programs from a DOS disk to a CP/M disk. You may be required to make minor changes (if any) to the program, but it is convenient.

Documentation

In a few words—good, but not perfect. The 136-page manual will not teach anyone how to program; it is meant to be a language reference manual only. If you already know how to program in Basic, you can quickly learn APCBASIC with this logically arranged manual. There is a special section on APCBASIC for NSBasic users which summarizes the differences between the two languages, as well as another section for CP/M users (APCBASIC is available for North Star DOS as well). The index is 17 pages long and arranged two columns per page with about 2,000 entries. Anyone who is familiar with micro software documentation will be impressed by that alone! The manual's biggest weakness is a lack of examples for the more advanced features. While the descriptions and explanations are reasonably clear, some of the new functions will be unfamiliar to most users. More suggestions on uses of these more powerful features would be appreciated.

Other comments

Portability of application software among different operating systems is directly dependent upon the identical language being available for each operating system. This laudable goal is being addressed directly by American Planning Corporation. Their Basics will be completely compatible, regardless of the operating system. Of course there will be some differences in speed and internal construction due to the different processors, and the 16-bit versions have some OS-specific compatible enhancements. For example, the release for MS-DOS 2.0 will allow separate 64K areas for program, data, buffers, and stack. But enhancements continue to be added to all versions.

I would be remiss if I didn't point out a few flaws in APCBASIC. After all, even a Mercedes-Benz still isn't a Rolls Royce! The most damning criticism I can direct toward it is lack of long variable names. If Basic is to survive as a serious programming language, one- and two-character variable names must go! To be honest, I would delay purchase of APCBASIC until this is remedied. Luckily, this will be fixed in the next release. And in typical APC "overkill" style, variable names will be up to 255 characters long. In a Basic with so many new functions, I was surprised that a SORT verb was not implemented. The SWAP statement helps speed things up, but a simple in-memory SORT statement would be even better. APC should follow the lead of baZic and provide terminal customization for 'clear screen' and direct cursor postioning for a PRINT AT(X,Y) statement. Since we are clearly going beyond ANSI standards, let us dream on a bit. I appreciated the MIN and MAX functions, but their use depends upon having separate variable names in the variable list [i.e., MAX(A1,A2,B,C4, . . . ,Z9)]. To be really useful, these functions should accept array variables (à la APL) to return the minimum or maximum value W in the array. And why not take a page or two from spreadsheet calculators by implementing SUM, AVERAGE, COUNT, and LOOKUP as well?

It may appear that APC is a software "David" taking on the Microsoft "Goliath," at least with its version of Basic. But APC, founded in 1975 to build computer simulation models for the Office of the Chief of Naval Operations, has been around longer than Microsoft. In 1977 they set up their own in-house microcomputer system and changed their focus from time-sharing-oriented naval systems consulting to developing and implementing turnkey microcomputer systems for third-party clients. They intended the initial version of APCBASIC for use as a more efficient in-house tool when they became dissatisfied with some of the limitations of NSBasic. They also market application software such as their Management Information System Builder (a database management program written in APCBASIC that has several advantages over dBASE II and others), a client prospect management system, a mailing list management system, and a special U.S. Congressional mailing list system with biographies and Congressional District profiles for every member of Congress as well as the top financial contributors to each!

Conclusions

I really have only a few minor quibbles about this fine Basic interpreter with significant yet compatible extensions to NSBasic. All in all, APCBASIC is the Basic interpreter

APCBASIC has gone an order of magnitude beyond anyone, with features that are of great value to systems developers who want as many useful programming conveniences as can be reasonably provided.

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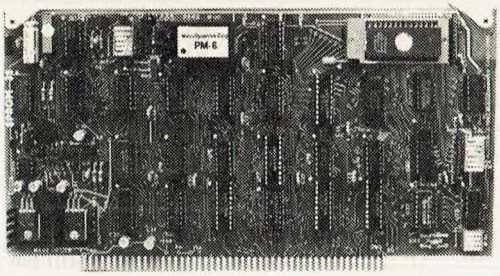

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APCBASIC continued . . .

that NSBasic should have evolved into. While the $400 price is a significant investment for "yet another Basic," APC does go out of its way to convince you that it is worth every penny. They offer a demo version for $50 which limits its memory and file sizes, but otherwise has all the features and does include the reference manual. They also offer a second operating system version for the same CPU for just an additional $50. And to make it even more attractive, they offer a money-back guarantee on both the demo and the full version. APC does have one other related product which they have not emphasized, but which may help you decide to purchase their Basic. For $195 they will supply a translator program that takes MBasic ASCII source code and converts it to APCBASIC. APC claims that the translation is 90 to 95% complete. I have not reviewed this program, so I cannot vouch for its effectiveness. This translator will probably become a more useful tool when the long variable names are implemented in the next release. Personally, I think it should be included as a utility in the system itself. As a separate utility, they will probably only sell it to a few systems developers; as part of the package, it just might provide the incentive to buy for those with a lot of effort invested in MBasic programs.

APC comments: *A new version of the software and an update of the documentation are now on the market.*

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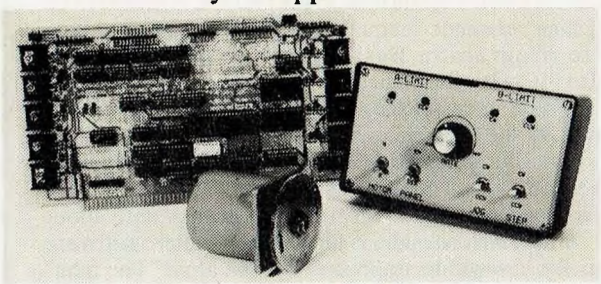

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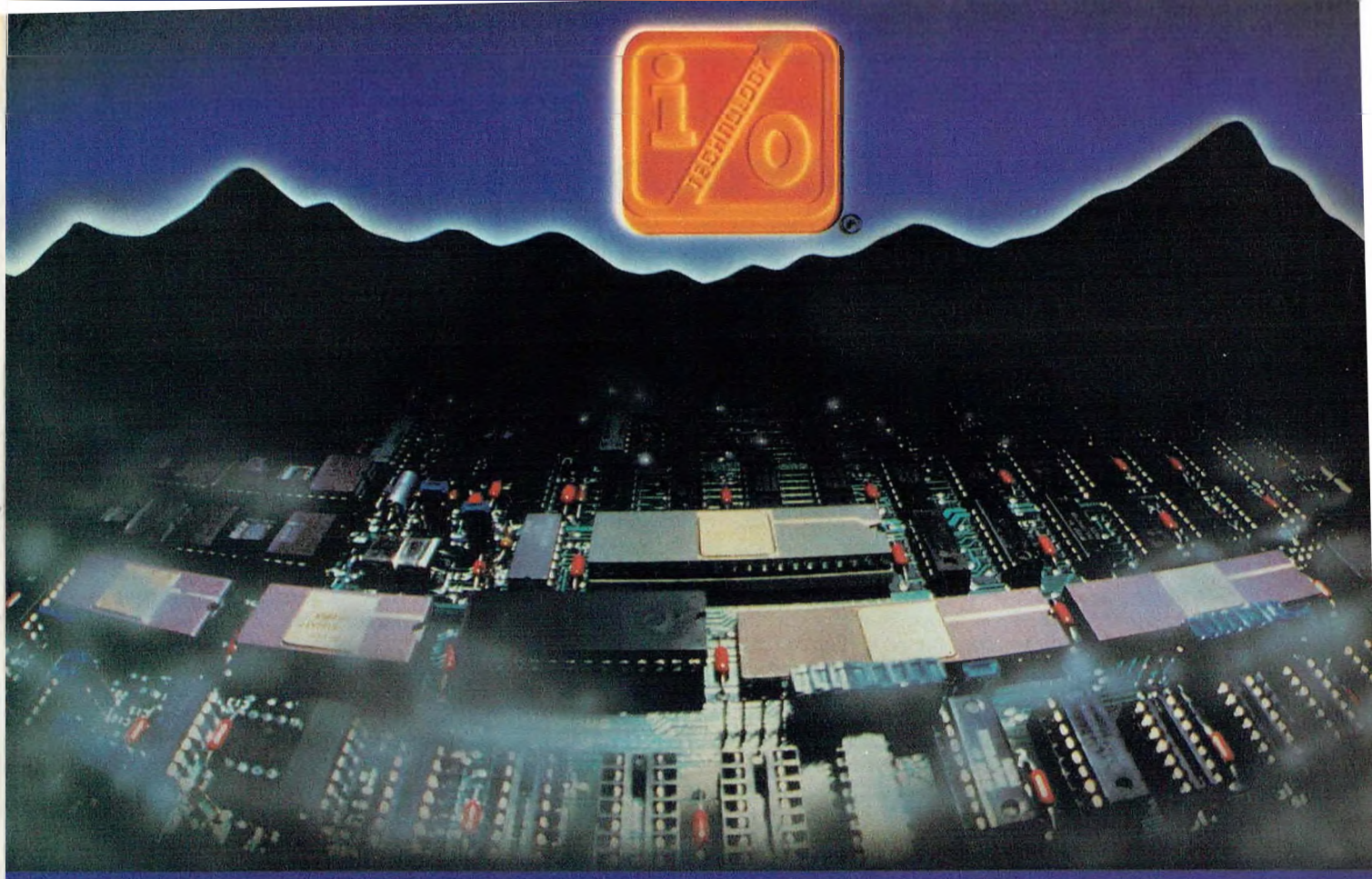

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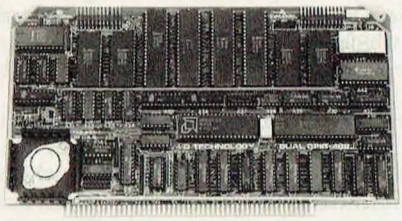

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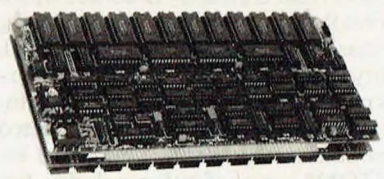

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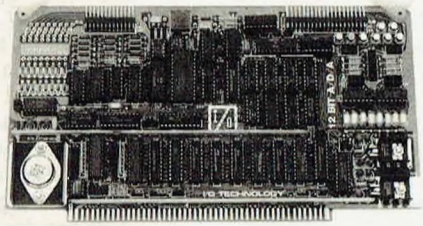

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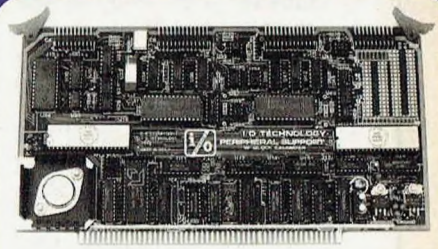

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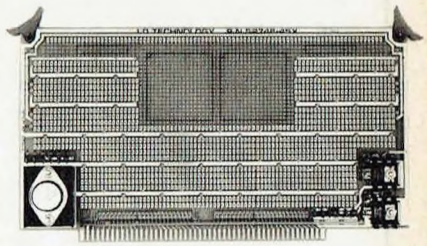

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The MicroDynamics S-100 EPROM Programmer

by Ian F. Darwin

One of the joys of being known as a reviewer is that you sometimes get new toys to play with. Just after my review of the ADS Promblaster appeared in the February 1983 issue of *Microsystems*, I was approached by MicroDynamics to review one of their new products, the EPROM-32. After a few phone calls and some discussion, they mailed me an assembled and tested board on February 3rd, and we waited.

While you wait along with me, let me point out that the MicroDynamics board differs from the ADS board in several respects. It uses personality modules to set up the board for each different type of EPROM. And it runs in either port-mapped or memory-mapped mode. But the similarities are numerous, too. A proper comparison, though, will have to wait for a future article I'm planning, which will summarize the features of *all* the IEEE-696 S-100 EPROM programmers.

Since we're still waiting for the Post Office, let me pour you another cup of coffee and explain about EPROMs. (If you've heard all this before, I won't think it rude if you skip to the next paragraph.) The "M" is for Memory—these are ICs that store data in your computer just as normal memory chips do. The "RO" is where the difference comes in—these are Read-Only chips. If you put them in a normal memory board that has the right sockets and write something to them, nothing will happen. However, the "P" tells you that they are Programmable by your computer with a special board: an EPROM programmer or "blaster." Programming an EPROM consists of writing data into it accompanied by "programming pulses" at special voltages on "program enable" pins (see References at the end for more information). The "E" stands for Erasable. These chips can be Erased—not with a pink eraser but with a special ultraviolet light. *(Caution: The UV light in EPROM erasers is hazardous to your eyesight!)*

An EPROM is thus a reusable memory chip that you can use to store programs and/or data for some extended period of time. Chances are your floppy disk "boot" program or your system monitor is in an EPROM inside your system right now. Look for a 24-pin chip with a glass window on top, which may be covered by a paper label to keep out stray UV light—that's the EPROM. (Apples, TRS-80s, and some other machines store their boot and other resident software in PROMs that are not reusable.) The data stored in an EPROM will "never" go away on its own, even with the power turned off. Not within decades in normal circumstances, three or four years under fluorescent light with the window uncovered, or as little as a month in direct sunlight with the window exposed!

The hardware

The board came through customs at the end of February.

Ian F. Darwin, University of Toronto Computing Services, 255 Huron St., Toronto, Ontario

A nicely laid out board, it has the programming socket and the personality module socket at the top of the board, as well as a LED to indicate when programming is actually taking place. The manual, however, was a preliminary one; the new one was to be shipped by around the beginning of April. (As of mid-May, when this review was written, there still was no revised manual.) The preliminary manual, despite having a number of corrections and changes marked in by hand, was both complete and comprehensive and included theory of operation, switch settings, and several pages of example runs from the interface program. Everything but an index. Some sections were a little roundabout, but I did find all the information I needed. The revised manual arrived in August; it's a cleanup and update of the older one. Schematics and layouts are now included and the text has been revised in several places.

The MicroDynamics board has the ability to program nine different EPROM configurations, from 2K up to 16K, using the personality modules provided (see Table 1). Both 24-pin and 28-pin EPROMs can be accommodated. These are listed, with the EPROM types they support, in Table 1. Presumably a later module will allow access to the 27256. The modules have to be kept track of, so they are labelled PM-1, PM-2, and so on. To select the right module, however, you have to turn to a table near the middle of the manual to see which one is required for a particular PROM. It might be a nice idea to mark each module with the EPROM types it supports.

The internals of the personality modules are secret, sort of. A dedicated hardware hacker could figure them out. The revised manual has a schematic of the board which names the signals presented to the personality module, but does not document the innards of the module. The modules I got were glued into plastic "header" boxes, and I didn't crack one open. If you want to know, buy the EPROM-32 and pry one apart!

An interesting feature of the EPROM-32 is that it can be either memory mapped or port mapped. In the port-mapped mode, the board occupies only four ports in your system's port space, accessible with an 8080/Z80 via IN and OUT instructions. You can set the board to any four-port boundary (0, 4, 8, ... 252). And MicroDynamics chose a default (38H-3BH) that is unlikely to collide with a large number of different floppy controllers, modem cards, etc., which (for some reason) tend to loiter around A0, B0, and C0. In the memory-mapped mode (where IEEE "extended addressing" is not usable), you must provide a window in your memory map as large as the EPROM selected by the personality module in the board. The board responds to the PHANTOM* signal of either polarity, but will not generate this signal itself. However, most memory boards I've seen expect the EPROM board to generate PHANTOM*. And since the RAM board I'm currently using has no provision for windowing, I've been unable to test the memory-mapped mode. The port-mapped mode, which is the one MicroDynamics seems to be emphasizing

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now, worked quite nicely for the samples I ran. The board was tested in two separate systems: an IEEE-696 standard one with the Godbout 85/88 CPU, and a nonstandard one with an old S.D. Systems CPU. The EPROM-32 worked with both systems.

Because it's a hassle to take your system apart whenever you want to insert or remove an EPROM, most makers of S-100 EPROM programmers build some kind of "PROM extender." MicroDynamics makes one as well. Like most extenders I've seen, this one is a ribbon cable that connects between the EPROM socket on the S-100 board and a small cabinet. It can be either hand-held or mounted on the front of your S-100 cabinet, or just placed on the table. But simply bringing the EPROM socket out to the front panel would not be enough, since you'd still have to power down and pull the board to change the personality module. So, reasonably enough, the MicroDynamics EPROM extender brings both the personality module socket and the EPROM socket out to the extender. A handy addition if you do EPROMs more than once a year.

Using the EPROM-32

Control is by a program called MDPGM, which comes on the disk in both source (.ASM) and executable (.COM) files, and there's a listing in the manual. *You can assemble it with the standard CP/M assembler,* and in fact must do so to switch from port-mapped mode (the default) to memory-mapped mode.

I generally dislike having to tell my computer something twice. So my eyebrows went up a little for the first time I ran MDPGM. For, having just put in the hardware personality module to tell the hardware that I was working with a 4K EPROM, I had to tell the software that I was working with a 4K EPROM. Computers get paid to do grunt work. I prefer the simplicity of an EPROM programmer controlled by software, in which you tell the software once that you're programming, say, a 2716. The software then sets up the hardware, and keeps track of the fact that it's 2K long. So I preferred the Ackerman Digital Promblaster. At least at first.

After using the ADS board for a while, I became familiar with it, and grew careless. One day I told it I was using 2716s, picked up a chip without really looking at it, and tried to program it. The chip, of course, was a three-voltage 2708. Bad things happened. The smoke came out of some of the transistors. And the switching regulator. I stopped smiling and phoned ADS. Their solution worked: replace all the transistors; if that doesn't fix it, replace the switching regulator. A dozen cheap plastic transistors, some running around, and one TL497 later, I was back on the air. It seems that a board as sophisticated as the ADS is not as robust as a simpler board might be. I've not tried anything so spectacular on the EPROM-32 (maybe I will just before I send my review board back, heh heh!) but I suspect it is more tolerant of user errors.

Table 1. EPROM types

Module	*EPROMs*
PM-1	2508, 2758, 2516, 2716
PM-2	2532
PM-3	2732, 2732A
PM-4	2564
PM-5	2764
PM-6	MCM68764
PM-7	2528
PM-8	27128
PM-9	27256

If the EPROM-32 doesn't have transistors to switch between the +21V supply that some EPROMS need for programming and the +25 others need, how does it switch the voltages? The answer is: um . . . er . . . well . . . it doesn't. A variable regulator (adjustable with a small screwdriver) sets V_{pp}, the programming voltage. MicroDynamics says in the manual that you can usually use +21V for such EPROMs as the 2716, which normally require +25V, if you're careful. They add: "If you plan to make frequent switches between 21V and 25V EPROMS, you may therefore want to leave V_{pp} set at 21V. We do suggest, however, that you make sure that this method works properly with your particular EPROM and application before using it extensively [Preliminary Manual, p. 3-3]."

The command set that MDPGM provides is similar to that of most CP/M debuggers, monitors, and EPROM programs. There are single-letter or few-letter commands to read/write files, dump/alter memory, load data from EPROMs and program data into them, and verify an EPROM either for unprogrammed conditions or against memory. The MDPGM software reads and writes files, but they are byte-for-byte binary reads. There's *no provision for Intel HEX format files* (such as ASM produces), hence no "checksum" verification of the files. However, text files and binary (.COM) files can be read in and programmed. A minor glitch is that MDPGM insists that you enter commands and operands in *upper case only* (Listing 1). It's really not that hard to recognize either upper or lower case and I'm disappointed when I find software that doesn't. But the software basically does what it should.

Also, I found out (without harming the board this time) what happens with certain setups when you put in the correct EPROM, but insert it upside down. *The little light inside comes on.* You didn't know there was a little light inside an EPROM, did you? Well, there isn't supposed to be, and it's not there any more anyway! The 24 tiny filaments—you can see them through the window—which connect the chip to the outside world glowed brightly for a second, then went to meet their maker. And one EPROM was no more.

Summary

The EPROM-32 is a reasonable EPROM programmer for the person or OEM wishing to program EPROMs from an S-100 bus system. It is a complete hardware and software package, and can program a wide range of EPROMs.

MicroDynamics comments: *The software allows you to specify the number of bytes to be programmed. This is useful if you wish to program only a portion of an EPROM. A new version of the software, with a provision for HEX file input and for the Intel fast-programming algorithm, will be available in early 1984.*

I found out what happens when you put in the correct EPROM, but insert it upside down: the little red light inside comes on!

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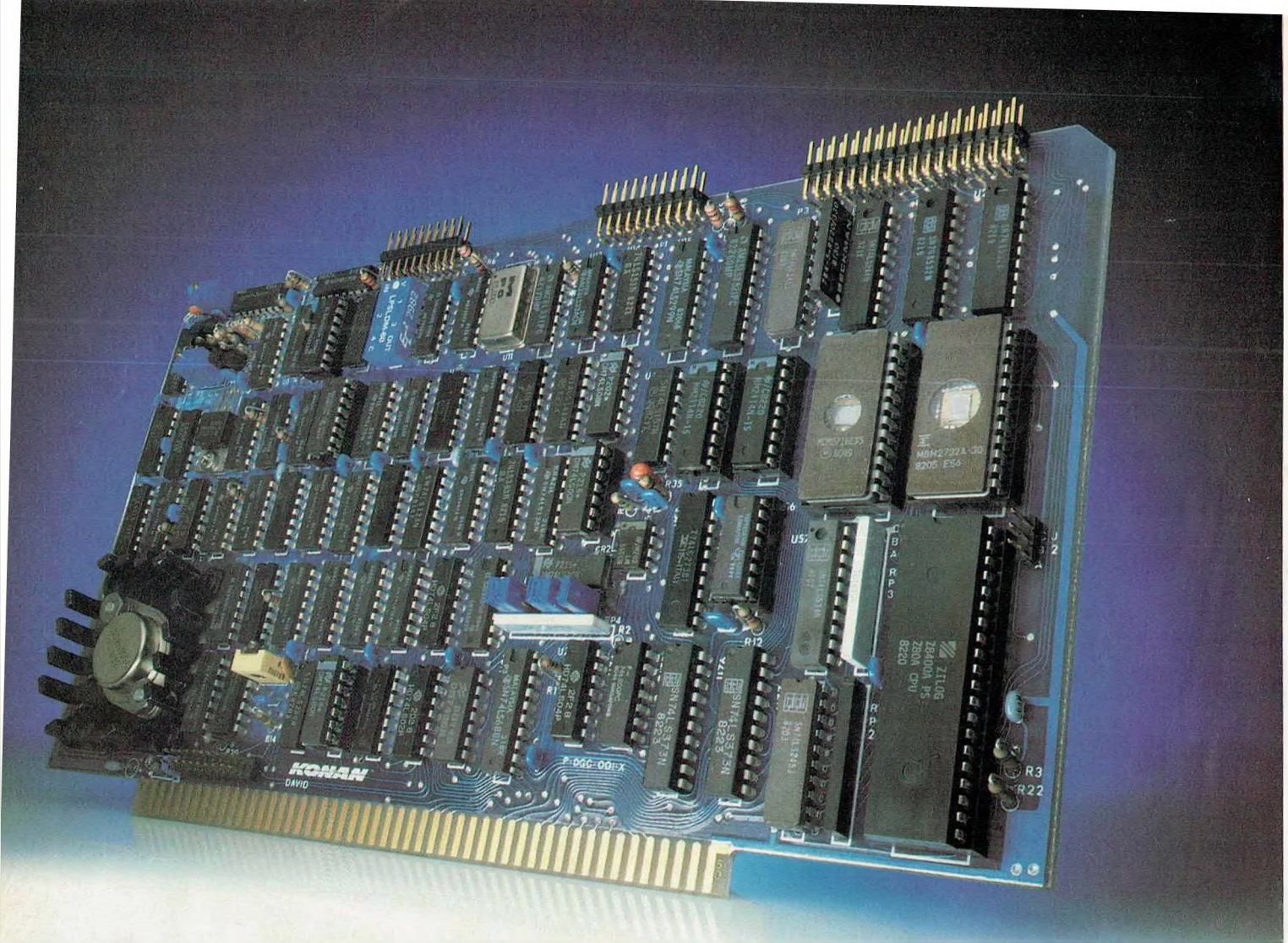

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References

Microsystems has reviewed two other S-100 EPROM boards, the Ackerman Digital Promblaster (February 1983, page 60), and the CerTek UNIPROM (July-August 1982).

The Intel *Memory Design Handbook* describes the details of Intel and similar EPROM technology.

At a glance

Name: EPROM-32 (hardware), MDPGM (software)

Use: For programming Erasable Programmable Read-Only Memories (EPROMs) from an S-100 bus computer system.

Manufacturer: **MicroDynamics**
6363 Poplar Avenue, Suite 105
Memphis, TN 38119
(901) 682-4054

System: S-100 bus. IEEE compliance claimed but not detailed. Tested with both prestandard and standard CPUs.

Features: Can use either port-mapped or memory-mapped mode.

LSI used: None.

Price: $269.95 with two personality modules; additional at $7.95 each.
Software, $9.95; extender box, $49.95.

Listing 1

```
A>
A>MDPGM

MDPGM  VERSION 1.0

THE CURRENT ADDRESS OF THE DATA BUFFER IS: 1000
ENTER NEW ADDRESS ("RETURN" IF NO CHANGE):

THE CURRENT DATA BUFFER LENGTH (HEX) IS: 0800
ENTER NEW LENGTH ("RETURN" IF NO CHANGE): 1000  ; it's a 2732.

THE CURRENT READ ADDRESS OF THE EPROM IS: 0000
ENTER NEW ADDRESS ("RETURN" IF NO CHANGE):

THE CURRENT EPROM PROGRAMMING ADDRESS IS: 0000
ENTER NEW ADDRESS ("RETURN" IF NO CHANGE):

>I
* INVALID COMMAND *

>L                                      ; commands must be in
                                        ; upper case!
                                        ; load the EPROM into memory

>D1000,80                               ; dump first 80H bytes
1000 00 00 02 08 FC 00 C8 3C 02 04 C1 FC 00 00 F6 FC
1010 02 AA 24 FC 02 EC 7C FC 02 76 EC 7C 00 00 3C 00
1020                                    ; and so on.

>S1004
1004 FC.FA

1005 00.^C

( now we remove the old EPROM and insert the new one)
>P

PROGRAMMING IN PROGRESS
***** PLEASE WAIT *****

>E
( return to CP/M )
A>
```


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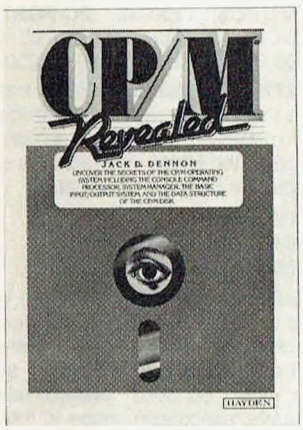

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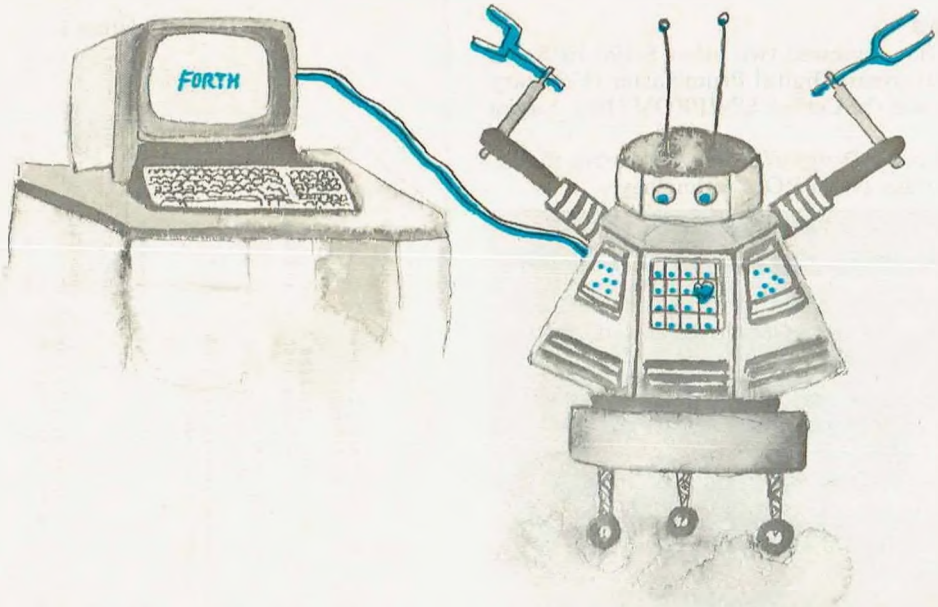

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FORTH Application Development Systems include interpreter/compiler with virtual memory management and multitasking, assembler, full screen editor, decompiler, utilities, and 130 + page manual. Standard random access files used for screen storage, extensions provided for access to all operating system functions.

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FORTH Native Code Compiler, requires Z-80 FORTH, CP/M 2.2, $100.00.

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Software floating point (Z-80, 8086, PC only), $100.00; AMD 9511 support (Z-80, 8086, 68000 only), $100.00; Intel 8087 support (8086, PC only), $100.00; Advanced color graphics (PC only), $100.00; Symbolic interactive debugger (PC only), $100.00; PC/TERM Communications/file transfer for Smartmodem, $60.00; Cross reference utility, $25.00; PC/GEN (custom character sets, PC only), $50.00; Curry FORTH Programming Aids, $150.00; Hierarchical file manager, $50.00; B-Tree index manager, $125.00; B-Tree index and file manager, $200.00; QTF + Screen editor for IBM PC, $100.00;

AUGUSTA, Ada subset compiler from Computer Linguistics for Z-80 CP/M 2.2 systems, $90.00.

"Starting FORTH" tutorial by Brodie, softcover, $16.00.

INTEL 8087-3 Numeric Coprocessor, $250.00.

83 – Standard version of all application development systems available soon. All registered users will be entitled to software update at nominal cost.

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Microsystems

CP/M SOFTWARE DIRECTORY

by Sol Libes, John Manno, Chris Terry

This is the first of what we expect to be an annual event in *Microsystems*. Six months of work went into its preparation. A mailing list of several hundred CP/M software vendors was compiled, and a questionnaire was mailed to each. Two additional mailings were made to those who did not respond to the first one. The final result was a directory containing close to 1,700 software items from more than 350 vendors. If you do not find a vendor or package listed, it is most likely because the vendor failed to respond to our questionnaire. In any event, if you believe a software package or vendor has been overlooked and should be added to the next directory, please let us know.

Some observations

Of the approximately 1,700 items in the directory, almost half are already available to run under CP/M-86. This is an indication that CP/M-86 is gaining wide popularity. However, there are fewer than 90 items in our directory that run under CP/M-68K, perhaps because CP/M-68K has only been available for a very short time.

Software that is oriented to specific industrial applications is by far the largest general class. Second is software for accounting use, and third are programs for general applications. The largest single category is that of programs for modem communications—in all, there are almost 100 of these programs. Second are engineering programs, followed by cross-assemblers and database managers.

Using the directory

The directory is organized into nine major applications categories with subcategories for specific applications. The program title, operating system under which it runs, price (where known) and a vendor code are given. At the end of the directory is a list of vendors with addresses and telephone numbers cross referenced to the vendor codes used in the software listings. The vendor code also acts as a reader service number on the special form included with the directory.

Although every effort has been made to make this list as complete and as accurate as possible, note that we cannot guarantee its accuracy.

The DOS (disk operating systems) under which these packages run are indicated as follows:

80 = CP/M-80, MP/M-80 or TurboDos. (Note that in some cases the software requires that a Z80 microprocessor be used in the systems.)
86 = CP/M-86 or MP/M-86
68K = CP/M-68K

PROGRAM NAME	DOS	PRICE	VENDOR
ACCOUNTING APPLICATIONS			
Integrated Accounting			
Accounting Plus	80,86		41
Your Accounting Solution	80,86	400	64
BACS (Integrated Accounting)	80,86		6
Firm I	80,86	995	27
FasTrak	80,86	5,000	129
Pro Bookkeeper	80,86,68K	199	81
Pro Bookkeeper with Quick Check	80,86,68K	250	81
Check Book	80,86,68K	29.95	81
Quick Register	80,86,68K	250	81
POST with Accounts Receivable	80,86,68K	300	81
Unit Inventory	80,86,68K	95	81
Unit Inventory with Sales Analysis	80,86,68K	150	81
Financial Utilities	80,86,68K	30	81
Pay Royalties	80,86,68K	50	81
Results	80	3,000	320
Inventory Control	80,86	600	348
IHCOME	80,86	600	348
Intgrtd Job Cst for Archt. & Engnrs	80	6,250	360
Star System 1-Accounting	80,86	1,250	536
The Accounting Partner	80,86	395	536
Integrated Business Accounting	80	95	575
MCBA Accounting Series	86	1,000	531
BusinessMaster Plus	80,86	495	65
APL	80,86	300£	22
Time Accounting & Billing	80		394
Accounting Software & Manufacturing	80	140-350	95
VanData	80	250	153
Multi Journal Accounting	80	600	153
Account Star	80	495	414
Desktop Accountant	80	395	483
"Mini-Pak" General Accnting System	80,86	1,200-4,000	62
B.I.S. "Time-Pak" Profssl billng	80,86	1,000-1,250	62
Church Integrated Accounting	80,86,68K	750	82
American Sysems/2 Accounting Pkg	80,86,68K	695	28
Codedata General Accounting Pkg	80,86	300	86
PeachPak/4	80	395	439
Sales Invoicing	80	750	439
Account Star	80	495	414
Solomon Series II Software	80	101	640
Multi-Entity/Prtshp Acc/Reportng	80,86	1,995	645

PROGRAM NAME	DOS	PRICE	VENDOR
ACCOUNTING APPLICATIONS			
TCS	80	250	153
Client Write-Up	80,86	995	133
Estimate Cost of Materials	80,86,68K	50	81
Datawrite	80	3,995	7
ADS Invcng w/Accnts Recvbl/Invntry	80	895	650
IB	80	500	662
Accounting Pkg	80	300	657
General Ledger			
BACS (General Ledger)	80,86		6
The Little General	80,86	195	27
General Ledger	80	229	4
General Ledger	80,86	75	86
General Ledger	80	795	344
General Ledger	80,86	600	348
General Ledger	80,86	499.95	353
Multi-Company General Ledger	80,86	995	380
General Ledger	80,86,68K		542
General Ledger	80,86	99	563
General Ledger	80,86	995	303
The Software Fitness Program	80,86		424
General Ledger	80,86	600	348
Desktop Accountant General Ledger	80	195	483
Church General Ledger	80,86,68K	250	82
Dataloc General Ledger	80,86	1,500	156
Bookkeeping System	80	300	157
General Ledger	80	750	439
General Ledger	80	595	642
General Ledger	80,86	250	63
TCS Total Ledger	80		569
General Ledger	80,86	450	279
General Ledger II	80,86	850	279
Fund Accounting	80,86	650	279
IMS General Ledger	80,86	450	279
ADS General Ledger	80	48	650
Payroll			
BACS (Payroll)	80,86		6
Payroll	80,86	75	86
Pay-ware	80,86	295	113
Tim III	80	495	153
Results	80	100	320
Payroll	80	795	344
Payroll	80,86	499.95	353
Payroll	80,86,68K		542
TCS Total Payroll	80		569
Payroll, multi-state, multi-dep't	80,86	995	303
Payroll	80,86		242
Desktop Accountant-Payroll	80	195	483
Desktop Inventory Manager	80	295	483
American Systems/2	80,86,68K	195	28

PROGRAM NAME	DOS	PRICE	VENDOR
ACCOUNTING APPLICATIONS			
Union Payroll			
Payroll System	80	400	157
MCS-3 Manufacturing Control System	80,86	750	359
Payroll/Personnel	80	1,495	642
Payroll	80,86	650	279
School Payroll System	80	500	491
IMS Payroll with Labor Distribution	80,86	850	279
ADS Payroll	80	485	650
Accounts Payable			
BACS (Accounts Payable)	80,86		6
Accounts Payable	80,86	75	86
Accounts Payable	80	795	344
Accounts Payable	80,86	600	348
Accounts Payable	80,86	499.95	353
Accounts Payable	80,86,68K		542
Accounts Payable/ Purchase Order	80,86	99	563
TCS Total Payables	80		569
Accounts Payable	80,86	995	303
Accounts Payable	80,86		242
Accounts Payable	80,86	600	348
Desktop Accountant-Accnts Payable	80	195	483
Dataloc Religious Payables	80,86	1,200	156
Dataloc Payables	80,86	1,200	156
Accounts Payable	80	750	439
MCS-3 Manufacturing Control System	80,86	750	359
Accounts Payable	80	595	642
Accounts Payable	80,86	90	63
The Software Fitness Program	80,86		424
PeachPay Payroll System	80	750	439
Accounts Payable	80,86	650	279
Accounts Payable System	80	250	491
IMS Accounts Payable	80,86	650	279
IMS Payroll w/Labor Distribution	80,86	850	279
ADS Accounts Payable	80	485	650
Accounts Receivable			
BACS (Accounts Receivable)	80,86		6
Accounts Receivable	80,86	75	86
Accounts Receivable	80	795	344
Accounts Receivable	80,86		348
Accounts Receivable	80,86	499.95	353
Contract Billing	80,86	499.95	353
Accounts Receivable	80,86,68K		542
Acc.Recbl/Invcng/ Sales Analysis	80,86	99	563
Accounts Receivable Balance Forwrd	80,86	99	563
Membership Accounts Receivable	80,86	99	563

PROGRAM NAME	DOS	PRICE	VENDOR
ACCOUNTING APPLICATIONS			
TCS Total Receivables	80		569
Open-Item Accounts Receivable	80,86	995	303
Accounts Receivable	80,86		424
Accounts Receivable	80,86		348
Desktop Accountant-Accnts Recbl	80	195	483
Dataloc Religious Offertory	80,86	1,500	156
Dataloc Receivables	80,86	1,500	156
Accounts Receivable	80	750	439
MCS-3 Manufacturing Control System	80,86	750	359
Accounts Receivable	80	595	642
Accounts Receivable	80,86	90	63
The Software Fitness Program	80,86		424
Balance Frwrd Accounts Receivable	80,86	650	279
Open Item Accounts Receivable	80,86	650	279
IMS-Balance Forwrd Accnts Receivable	80,86	650	279
IMS Accounts Receibl-open item	80,86	650	279
ADS Accounts Receivable	80	485	650
ADS Accounts Receivable w/Invcng	80	585	650
Inventory			
BACS (Inventory)	80,86		6
Inventory	80,86	75	86
TCS Inventory	80	99	153
Inventory to Assembly Level	80	100	201
Inventory Control	80,86,68K		542
Inventory Control	80,86	99	563
Retail Apparel Inventory & PO System	80,86	6,500	303
Inventory	80,86		242
S.A.I.L. Inventory System	80,86	1,000	489
Flex Manager Retail Invtry Cntrl	80,86	2,995	447
Dataloc Inventory Management	80,86	1,500	156
Inventory Control	80	750	439
MCS-3 Manufacturing Control System	80,86	2,500	359
Inventory Control	80	595	642
Inventory Control	80,86	600	348
The Software Fitness Program	80,86		424
Inventory Control with Purchasing	80,86	650	279
IMS Inventory Cntrl Sytm w/Purchasing	80,86	650	279
ADS Inventory	80	485	650

ACCOUNTING APPLICATIONS

PROGRAM NAME	DOS	PRICE	VENDOR
Order Entry			
BACS (Order Entry)	80,86		6
Sales Solution Plus Order Control	80,86	695	64
Order Entry (DBase)	80	100	201
Order Entry	80,86	600	348
Order Entry	80,86,68K		542
TCS Total Sales	80		569
Order Entry	80,86		242
Order Entry	80,86	600	348
"BIS-PAK" Order Processing System	80,86	2,000-5,500	62
MCS-3 Manufacturing Control System	80,86	1,700	359
The Software Fitness Program	80,86		424
Order Entry and Invoicing	80,86	650	279
IMS Order Entry And Invoicing Sytm	80,86	650	279
Cash Disbursements			
Church Disbursements	80,86	250	82
Cash Receipts and Disbursements	80,86	200	279
Expense/Cash System	80	500	214
Checkwiz	80	49.95	609
IMS Cash Disbursements & Receipts	80,86	200	279
Cash Receipts			
Church Receipting	80,86,68K	250	82
Student Billing System	80	250	491
IMS Cash Receipts & Disbrsmts Sytm	80,86	200	279
General Journal			
Financial Management System	80,86	149.95	191
Book Keep	80,86	69.95	191
Sales Journal			
Customer Profile	80,86	59.95	191
Job Costing			
Job Cost Accounting Program	80,86	495	200
Job Cost	80	795	344
Contractors Job Costing	80,86	399.95	353
Payroll/Job Costing	80,86	99	563
Job Costing	80,86	1,850	303
Job Cost	80,86		424
American Systems/2-Job Costing	80,86,68K	695	28
Job Cost System	80	750	439
The Software Fitness Program	80,86		424
Professional Time Accounting	80	595	234
Job Accounting	80,86	650	279

ACCOUNTING APPLICATIONS

PROGRAM NAME	DOS	PRICE	VENDOR
IMS Job Acounting System	80,86	650	279
Fixed Assets Accounting			
IMS Fixed Assets System	80,86	300	279
Fixed Assets Accounting	80	149	4
Fixed Assets Management	80	350	234
Fixed Assets Accounting	80,86	350	303
Fixed Assets Accounting	80	750	439
Fixed Assets with Depreciation	80,86	300	279
Spreadsheet			
Calcstar	80,86		382
TRSDOS VisiCalc under CP/M	80	99	43
ProfitPlan	80,86	195	78
FINAR	80,86	695	220
Professional Time Accounting	80	595	234
InteCalc	80	295	282
Zencalc Spreadsheet	80	49.95	521
Magic Worksheet	80,86,68K	295	542
Multiplan	80	275	383
PeachCalc	80	150	439
Scratch Pad	80,86	295	548
WordPlan	80,86	125	162
MicroPlan	80,86	495	78
Consolidation Module	80,86	295	78
Link Module	80,86	295	78
FilePlan	80,86	295	78
Target PlannerCalc	80	99	648
Supercalc	80,86		525
WES	80	295	602
Budgeting			
The Home Accountant Plus	80	99.95	127
Microfile	80	150	464
DDS-II	80	150	464
Salcalc	80	50	491
Other			
Double Entry Fund Account System	80	350	491
Fund Accounting System (Ver.1.0)	80	250	491
Fund Accounting System (Ver.2.0)	80	250	491
Checkbook	80	49.50	93
Purchase Order Management	80,86	650	138
Portfolio Management System	80,86	700	138
Money Maestro	80	125	269

PROGRAM NAME	DOS	PRICE	VENDOR
ACCOUNTING APPLICATIONS			
Amortize	80	85	163
Client Write-Up	80	795	344
Micro-Tax Level I	80,68K	195	388
Micro-Tax Level II	80	1,000	388
Micro-Tax Level III	80,68K	1,000	388
Micro-Tax State Packages	80,68K	250-750	388
Quantitative Business Decisions	80	49.95	543
Model 1040	80	195	545
Include	80	125	163
The Loan Arranger	80	299	624
Inventory Control	80,86	600	348
Church Mouse	80,86	6,000	489
The Managing Partner	80	1,575	292
Tax Break Planner	80	180	455
Client Pstng/Actng-multiledger	80	750	439
Stats-Graph	80	200	548
Mortgage Loan Servicing	80,86	3,495	645
Client Write-Up	80,86	995	133
Quick-Tax tax preparation	80	1,250	470
VP/Finance	80,86,68K	295	651
ADS Small Bookkeeping/Pblc Accntnt	80	895	650
E-ZTax	80,86	69.95	678
GENERAL APPLICATIONS			
Communications			
Crosstalk	80,86	195	385
Remote	80	150	385
Correspondence Management System	80,86		6
MicroTLX	80	150	14
Intelligent Terminal	80	150	14
MicroEZLINK	80	150	14
Port-to-Port	80	175	12
OZMOSIS	80	150	12
R.T.D.	80	85	12
COMCOM	80	95	92
Terminal	80,86	125	199
File Mover	80,86	59.95	199
(SYNCX) Network Station	80,86	200	219
CRTXE-Network Station w/Emulation	80,86	250	219
Rem Com	80	25	243
Smartcom II for the Kaypro II	80		247
Smartcom II for the DEC Rainbow	80,86		247
Smartcom II for the Xerox 820II	80		247
COMMX-PACA	80	150-900	245
COMMX	80,86	99-700	245
CONSOLX	80,86	200-300	245
BIS-3780	80,86	695	256

PROGRAM NAME	DOS	PRICE	VENDOR
GENERAL APPLICATIONS			
Acculink	80,86	245	256
BIS-HASP	80,86	995	256
InfoShare	80,86	250	265
Lync	80	155	277
The Benchmark (R) Telecomm. Prgm	80,86	150	339
BIS-3270	80,86	695	367
BIS-3780	80,86	695	367
BIS-HASP	80,86	995	367
Micro-SNA/3270	80,86	695	367
Micro-SNA/3770	80,86	695	367
COAXXSYS	80,86	1,195	367
Pathway/SNA-3270	86,68K	595	437
Pathway/SNA-3770	86,68K	495	437
Pathway/BSC-3270	86,68K	595	437
Pathway/BSC-3770	86,68K	495	437
Pathway/2780/3780	86,68K	495	437
Cleo 3780	80,86	395-750	444
Cleo 3270	80,86	395-980	444
Softcom-Telecommunications Utility	80	150	520
Reach Modem/File Transfer	80	19.95	521
3780/2780 and 3270 Emulation	80,86	995	608
SM-Modem	80	95	324
RBTE 80	80	500	153
Message	80,86,68K		577
Notebook	80,86,68K		577
Bulletin	80,86,68K		577
Phone	80,86,68K		577
Intellicom	80		117
Ascom	80,86	175	192
SYNC/COM	80,86	395	192
Alpaca-Plus	80	500	478
ASYNC	80	100	478
SYNCH 2780/3780	80	500	478
SYNCH 3270	80	750	478
B.I.S. "BISMOD" Telecommunications	80,86	100	62
Mcall	80	85	345
Mcall-II	80	125	345
AMcall	80	150	345
American Translator	80,86,68K	99.95	28
Modem 86	86	89	122
Telecommunications	80	150	439
CBB-Bulletin Board	80	50	79
Mcall	80,86	99.95	79
AMCall	80,86	99.95	79
CCS Communications	80	79.95	104
Telex-Link	80,86	350	74
Computer-Telex-Link	80,86	165	74
Wall-Street-Link	80,86	165	74
Computer-Phone-Link	80,86	165	74
Lync 3.0	80	150	445
The Micro Link II	80,86	99	177
TermII	80	200	548
R.T.D.	80	85	12
TLX-A-Syst	80	250	644
Dataloc Fund-Raiser	80,86	1,200	156
The File Transporter	80	69.95	614

PROGRAM NAME	DOS	PRICE	VENDOR
GENERAL APPLICATIONS			
Electronic Mail Manager	80	300-400	80
Hayes Terminal Program	80	99	247
Smartcom I for Apple II, II+, IIe	80		247
DataTalker I	80,86	995	608
Intercom Complete	80,86	600-750	36
Intercom Utilities	80,86	250-325	36
Communications-Osborne Executive	80	99	609
Communications-Osborne 1	80	49.95	609
Mite	80	150	664
Modem	80	40	658
Calendar/Scheduler			
Tickle	80,86	19.95	35
Intercom Utilities	80,86	250-325	36
Intercom Complete	80,86	600-750	36
Calendar/1	80	60	83
Executive Manager	80,86	295	138
IntePlan	80	149	282
Agenda	80,86,68K		577
Personal Calendar	80	195	439
Project Management System	80	250	439
Priorities	80	199.50	253
Appointment Manager	80,86	59	86
Communications	80	69.95	679
Electronic Mail			
Micro E.Com	80		478
B.I.S. "E-COM"	80,86	95-500	62
Coram-A-Syst	80	250	644
Micro Link II	80,86	99	177
Financial Planning			
Micro Financier	80		611
Financial Modeling System	80,86		6
Personal Value	80,86	34.95	35
Financial Utility I	80	139	4
Financial Utilities	80,86,68K	30	81
Microplan	80	495	153
Minimodel	80	495	153
Target Interchangeable	80	139	153
Target Planner	80	195	153
Target Planner Demo	80	75	153
Target Task	80	329	153
Credit Rating Booster	80,86	23.95	191
Options Analysis	80,86	99.95	191
Personal Balance Sheet	80,86	29.95	191
PortFolio Management	80,86	69.95	191
Tax Optimizer	80,86	59.95	191
Microcomputer Bond Program	80,86	59.95	191
Microcomputer Stock Program	80,86	59.95	191
Personal Finance System	80,86	39.95	191
ProPlan	80	8,300	460

PROGRAM NAME	DOS	PRICE	VENDOR
GENERAL APPLICATIONS			
Math of Finance	80,86	17.95	632
Records	80,86,68K		577
NWA Statpak	80,86	495	415
Investment Software	80,86,68K		347
ProPlan	80	10,000	460
Plan 80	80,86	295	177
Financial Analysis	80,86	49	386
Target Financial Modeling	80,86	325	648
Games			
Orbquest	80	39.95	177
Eliza	80,86	25.45	38
Crypto	80,86	17.95	191
Handicapper	80,86	33.95	191
Eliza II	80,86	19.95	191
Star Con	80,86	19.95	191
Ironclads	80,86	29.95	191
Uncle Harry's Will Adventure	80,86	24.95	191
Cranston Manor Adventure	80,86	19.95	191
Gamball Rally Adventure	80,86	21.95	191
Moon Probe	80,86	18.95	191
Games Pack I	80,86	18.95	191
Games Pack II	80,86	18.95	191
Starbase 3.2	80,86	17.95	191
Chess Master	80,86	23.95	191
Backgammon	80,86	23.95	191
Flight Simulator	80,86	23.95	191
Valdez	80,86	23.95	191
Space Lanes	80,86	14.95	191
Management Simulator	80,86	29.95	191
Bridge Master	80,86	29.95	191
Blackjack Coach	80,86	33.95	191
Go Fish	80,86	18.95	191
Poker Party	80,86	23.95	191
Televideo Games-Pak	80	46.50	215
Word Wiggle Letter Game	80	29.95	521
Arcturus Exterminator Video Game	80	24.95	521
Arcturus Control Video Game	80	19.95	521
Snake Video Game	80	19.95	521
Original Adventure Game	80	19.95	521
Eliza Conversational Game	80	24.95	521
Space Pirates Video Game	80	19.95	521
Munchkin Video Game	80	19.95	521
Mychess Championship Game	80	34.95	521
Grafix-Pac 1	80	249	245
Analiza II	80	50	548
Nemesis	80	45	548
Invaders Video Game	80	19.95	521
Play/Mate	80	65	451
Airport Action Games	80	19.95	521

PROGRAM NAME	DOS	PRICE	VENDOR
GENERAL APPLICATIONS			
Arcturus Ranger Video Game	80	24.95	521
Joystick	80	49.95	609
Shootout	80	24.95	609
Kamakaza Ozzy	80	24.95	609
Games Disk #4	80	49.95	609
Games Disk #5	80	49.95	609
Games Disk #6	80	49.95	609
Graphics			
Osbrief	80	25	609
Osgraph	80	49.95	609
Osboard 1	80	49.95	609
Grafpower	80,86	149	120
EmuPlott III-3 Dimension Graphics	80	300	219
Graphwriter	86	395	244
GRAPH	80	55	329
XCEL 3-D Generator	80	345	330
XCEL Graphics Surface Plotter	80	175	330
XCEL Graphics Symbol Generator	80	175	330
XYPLOT	80	95	163
Graph	80	95	163
Ed-A-Sketch Graphics Editor	80	29.95	521
dGRAPH	80,86	295	231
Auto-Cad	80	895	293
grafTalk	80	450	478
grafLib	80	400	478
QCAL	80,86	295	574
Dataloc Fund-Raiser	80,86	1,200	156
VBasic	80	89-239	245
Sketch	80		245
Peachtree Graphics Language	80	395	439
Business Graphics Syst	80	295	439
GRAPH	80	95	163
XCEL Graphics Graph Plotter	80		330
XCEL Graphics Terminal	80	195	330
XCEL Screen Printer	80	65	330
GraphPlan	80,86	295	78
Micro Link II	80,86	99	177
Mesh-Plot	80	59.95	680
Dataplotter	80,86	50	659
PlotPak	80	275	653
Music			
Synio Music Synthesizer Software	80	350	73
Sort			
Sort/B Hybrid Sort	80	75	555
Power Sort	80,68K	95	268
Co-Sort	80	200	268
Supersort 1	80	250	153
Statistics			
Abstat	80,86	395	30

PROGRAM NAME	DOS	PRICE	VENDOR
GENERAL APPLICATIONS			
Data-Fox Info. Analysis System	80	70	164
Analysis of Variance	80,86	43.95	191
Stattest	80,86	33.95	191
Multilinear Regression	80,86	28.95	191
Regression I	80,86	23.95	191
Regression II	80,86	23.95	191
Microstat	80	325	196
ELF-The Statistical Package	80,86	200	607
NWA Statpak	80,86	495	415
Other			
Synopsis	80	89	177
CPMCPM	80	65	92
Master Tax Program	80,86	1,695	133
Corporate 1120	80,86	500	133
Tax Planner	80,86	300	133
Roots/M	80	49.95	89
IntePERT	80	149	282
Dedicate/32	80	175	337
Computer Chef Recipe File	80	29.95	521
DataLock Data Encryption System	80,86	100	528
Recover	80	75	528
Data-Lock	80	95	528
NBAPICKS	80	19.95	543
Pick'em	80	19.95	543
Computer Companion	80,86	39.95	554
Practical Basic Programs	80	49.95	575
Cipher	80	60	624
General Purpose Decision Maker	80,86	24.95	632
Anthology I	80	99	187
Office Automator	80,86		577
BBA	80	29.95	253
Criterion Job Posting/reqtn trkng	80,86	495	643
WES	80,86,68K	495	602
Applicant Tracking	86	1,995	648
DATABASE PROGRAMS			
Database Manager			
MIS Builder	80,86	495	29
Sales Power!	80,86	149	120
DBPACK-II	80,86	395	92
DBPACK	80	195	92
Condor I	80	295	395
Condor Demo	80	75	395
DBase II	80	695	40
FMS 80	80	995	395
Quick NEasi	80	395	395
Probase	80	650	395
FMS-80	80,86	395	395
DBMS 111-7/The Key	80,86	295-595	237
DataBase 3	80	29.95	251
ALIST	80	50	251
ALIST +	80	80	251

PROGRAM NAME	DOS	PRICE	VENDOR
DATABASE PROGRAMS			
DBPLUS	80	125	254
InteBase with InteVate	80	495	282
Selector	80,86	900	365
KnowledgeMan	86	500	352
Personal Pearl	80,86	295	440
Info-80 Application Dev. System	80	395	520
Tarbell Data Base System	80	100	564
OmniBase	86,68K	720	123
MDBS III	80,86	2,200-30,000	274
Condor 1	80,86	259	124
Condor 3	80,86	650	124
Total Information Management	80,68K	495	271
DataFlex-80	80	990	9
DataFlex-86	86	1,250	9
Formula II	80,86	695	192
Dataloc Religious Organizer	80,86	2,500	156
Dataloc Religious Census	80,86	1,500	156
Dataloc "Tailored" Programs	80,86	1,500	156
Dataloc Management Organizer	80,86	1,500	156
Dataloc "What's What"	80,86	1,200	156
Data Manager	80	450	157
Superfile Database Manager	80,86,68K	710 £	527
Superfile	80	195	236
General Business System	80	650	467
Optimum D.M.S.-Executive Series	80,86	295	595
Optimum D.M.S.-Professional Series	80,86	595	595
Extnd-Ntwk DBMS cross-industry applicability	80		274
Extnd-Ntwk DBMS multiple user accs	80,86		274
MDBS-Education Aid	80,86		274
Condor III	80	650	153
MAG/base 1	80,86	295	317
MAG/base 2	80,86	495	317
MAG/base 3	80,86	795	317
MDBS I	80		630
MDBS III	80,86		630
TIM III	80	495	153
Sensible Solution/Procedural Language	80	995	9
Informa-X	80	995	9
MDBS I	80		274
Radar-high speed Data Entry	80,86	500	529
Sensible Solution/Procedural Language	80	995	79

PROGRAM NAME	DOS	PRICE	VENDOR
DATABASE PROGRAMS			
DataBase 3	80	29.95	251
Notebook	80,86	150	177
Datastar	80,86		382
Minimum Database 80	80	89.50	614
QPro4	80	395	471
RELMOD-80	80	350	681
Index Card File	80,86	35	676
Database System	80,86	35	676
Filebase	80	75	669
Data Entry			
Radar	80	495	529
"DE" Data Entry System	80	49.95	79
Keyed Access			
FABS-II	80	150	103
FABS/86-C	86	150	103
Basic B+	80	325	165
Data Retrieval System	80,86	29.95	191
KSAM80	80	95	204
MULTISAM	80	145	204
WordFinder	80	250	187
INSYST	80	1,595	204
"The CP/M Connection" (1)	80		204
"The CP/M Connection" (2)	86		204
Input Format Generator			
Quickscreen	80,86	149	231
Screen Master	80,86	700-1,900	274
Sort			
Autosort/86C	86	150	103
Autosort M/MR	80	150	103
Autosort C/CR	80	150	103
Sort Z.0-Disk Based Sort/Merge Uty	80	295	520
Q Sort	80,86,68K	100	542
"CS" Sort Program	80	25	79
Sort	80,86	35	676
Mail List Manager			
IMS Mailing List Management Sytm	80,86	300	279
Sales Solution	80,86	295	67
Mail List	80,86	89	86
Mailist	80	35	243
Mail80	80	295	441
MEDIC80	80	2,500-3,500	441
Dental80	80	2,500-3,500	441
CHIRO80	80	2,500-3,500	441
NAD	80,86,68K	175	542
TCS Q/Label	80		569
MEDIT-Mailing List	80	39	603
B.I.S. "Micro-Mail"	80,86	500-2,000	62
List Manager	80	250	439
The Benchmark (R)	80,86	250	339

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Users can be assigned their own work areas, thus one user can not affect another. All user printing is **"SPOOLED"** and will not tie up the users console. In addition, time consuming printing and other processes may be **"QUEUED"** or **"BATCHED"** to be run later.

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CCD-07001-01 CP/M 2.2, Teletex $150.00
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CCD-07003-06 M.S. Cobol-80 ..... $469.95
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CCD-07006-06 M.S. Multiplan $179.95
CCD-07007-06 Perfect Calc/Filer $299.95
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DATABASE PROGRAMS			
Mail List			
Mailer	80	100	329
Mailing List Management	80,86	300	279
Mail Order Marketing	80,86	6,200	58
The last NAD	80	99.95	582
Report Generator			
FRIEND The Report Generator	80,86	295	233
TCS SIMPLE	80		569
Progen/Repagen	80	99.95	614
The Software Fitness Program	80,86		424
Other			
ANSI STANDARD MUMPS	80,86	55	600
Household Goods	80,86	34.95	35
BallCard	80,86	34.95	35
WHATSIT	80	150	107
MAGART.DB	80	20	201
FORMS-3	80	40	201
SUPERFILE	80	175	201
The GEM System	80	250	505
Analyst	80,86,68K	250	542
TCS Total Utilities	80		569
DATAVU	80,86	250	579
Questext	80	299.95	264
MICROFILE	80	150	464
DDS-II	80	150	464
The Headhunter	80,86	1,995	645
Mail Order Marketing	80,86	6,200	58
Student Record System	80	250	491
Milestone	80,86	295	177
Filefix	80	89	177
Research Assistant	80	349	177
BLX-M	80	89	55
BLX-M Basic	80	89	55
BLX-C Basic	80	89	55
Eraq	80	29	55
Backup/Restore	80	49	55
Dsave	80	29	55
DB/Dialer	80	145	55
GraphPlan	80,86	295	78
FilePlan	80,86	295	78
Lucid	80,86	200	652
DBHelp	80	19.95	582
TEXT PROCESSING			
Text Editor			
MULTED	80,86	59	92
Nevada Edit	80	29.95	202
MicroEd	80,86	49	391
The Electric Blackboard	80	198	490
Pie 1.5 Full Screen Editor	80	29.95	521
PolyVUE	80	39.95	349
VEDIT	80,86	150-195	122
Volley	68K	225	602

PROGRAM NAME	DOS	PRICE	VENDOR
TEXT PROCESSING			
Pmate	80,86,68K	225	602
Star-Edit	80,86	225	548
OmniWriter	80	99	43
CSE	80,86	60	43
Zedit	80	50	657
Ztel	80	80	657
QED Editor	80	150	657
Text Output Formatter			
Smartprint	80		250
MicroScript	80,86	99	391
Text 4.0 Formatter	80	39.95	521
TECHTYPE	80	300	633
DocuPlan	80	295	78
Microscript	80,86	99	677
TopI	80	80	657
TopII	80	100	657
Word Processor			
MemoPlan	80,86	195	78
Write	80	239	614
The Benchmark (R) Word Processor	80,86	499.95	339
Office Advantage	80	9,995	2
Select: The Word Processor	80,86	495	495
Word Right	80,86,68K	495	542
The Word	80	75	153
Palantir Word Processor	80	450	435
American Typist	80,86,68K	39.95	28
PeachText	80	250	439
TeleStar	80	150-200	638
PeachText w/ Random House Thesaurus	80	300	439
Textwriter	80,86	125	177
WordStar	80,86		382
WES	80	295	602
Spellbinder	80	295	602
Typesetting			
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ET65J	80	195	379
Image Word/Graphics Processor	80	295	369
Spellbinder	80	395	631
MagicPrint	80	195	106
Microcomposer	80	1,100	143
Spelling Checker			
Electric Webster	80,86		131
The WORD Plus	80,86	150	418
The Benchmark (R) Spelling Checker	80,86	175	339
Spell Spelling Proofreader	80	49.95	521
Spelling Proofreader	80	150	439
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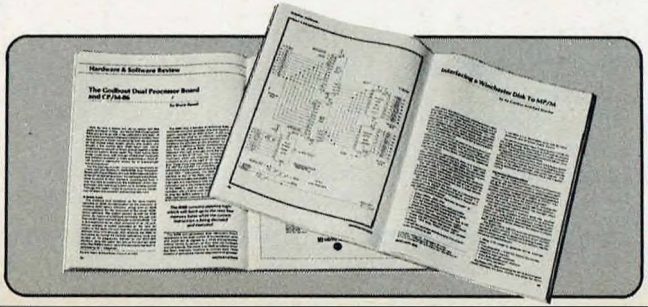

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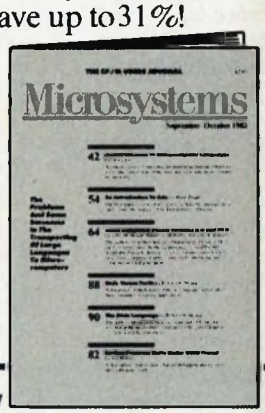

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Other			
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Memoplan	80	295	153
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DraftMaker	80	250	187
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Word Index II	80,86	195	637
The Fancy Font System	80	180	508
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Personal Datebook	80,86	150	177
Datebook	80,86	295	177
Cardfile	80,86	89	177
Bibliography	80,86	125	177
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Mailmerge	80,86	295	382
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Informa-X	80	995	9
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Invoicing Accounts Receivables	80,86	995	58
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American DataBid-General Estimtng	80,86,68K	195	28
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Dental			
Dental Office Solution Software	80,86	2,500	170
Dental Accounting System	80,86	2,995	182
Dental Office Solution	80,86	2,000	170
PAS-3 Dental	80,86	995	627

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INDUSTRY APPLICATIONS			
Dental80	80	2,500-3,500	441
MicroDent	80,86	2,200-4,300	36
Dental Office Manager	80		321
Dental Office Management System	80,86	2,000	279
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Education			
Teacher's Aide	80,86	17.95	191
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MathWiz	80	100	336
Kid Care	80		321
Testgen	80	55	491
Library Utilities	80	25-45	491
Attendance System	80	150	491
Engineering			
Scada	80,86,68K	5,500	25
Design Automation Syst. for PCBs	80	1,450	148
DISCO-SPECS	80,86	195	183
BEAM-1	80,86	145	183
TiltWall	80,86	125	183
PolEm	80,86	80	183
Footing	80,86	110	183
Pier and Grade Beam Design	80,86	150	183
ElFAn	80,86	220	220
RetWall	80,86	250	183
NRG-2	80,86	450	183
Earthwork	80,86	295	183
Hydraulics	80,86	295	183
Hydrology	80,86	295	183
Slope Stability Analysis	80,86	195	183
Survey 80/Stadia/Stadia Reduction	80,86	95	183
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Basic Scientific Subroutines, VI	80,86	53.95	191
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Comm. Heatng & Cooling Loads Pgm	80,86	995	331
2 Zone Version		295	331
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Unlimited Version		1,495	200
Comm. building Energy Anal. Prg.	80,86	695	200
microSUB: Math-Fortran Subroutines Library	80	250	228
TM-G2SSP SO	80	495	571
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muMATH	80	250	507
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Easi Concrete Column Design	80,86	99	195
Easi Concrete Slab	80,86	99	195
Easi Steel Beam Design	80,86	99	195
Easi Steel Column Design	80,86	99	195
Easi Truss	80,86	60	195
Easi "4" Structural Analysis Prgm	80,86	500	195
Easi "2" Structural Analysis Prgm	80,86	300	195
Easi Simplex	80,86	60	195
Hydraulic Pipe Design-HP2M	80,86	145	331
Life Cycle Cost	80,86	115	331
Residential Cooling & Heating	80,86	295	331
HVAC Energy Consumption EN4M	80,86	995	331
Fault Current Analysis-E3M	80,86	745	331
Fuse & Breaker Coordination-E4M	80,86	295	331
Lighting Design - E5M	80,86	495	331

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INDUSTRY APPLICATIONS			
Hardy Cross Water System-HP3M	80,86	245	331
Fire Sprinkler Grid Design-HP4M	80,86	995	331
Solar Collector F-Chart-SE1M	80,86	265	331
Finite Element Analysis-ST10M	80,86	895	331
Enhanced Finite Elmt Prg - ST 10MB	80,86	995	331
Auto-Load for ST10M (ST12M)	80,86	150	331
Shear Wall Design - ST14M	80,86	295	331
Comm. Cooling & Htng Load - ASHRAE	80,86	995	331
Duct Design (DD4M)	80,86	265	331
Heating Fuel Cost (HC3M)	80,86	95	331
Steel Beam Design - ST15M	80,86	195	331
Concrete Beam Design	80,86	495	331
Steel Column Design - ST17M	80,86	195	331
Concrete Column Design - ST	80,86	395	331
1-Way, 2-Way Concte Slab ST19M	80,86	495	331
Equipment Rental			
CONVOY	80,86	950	27
Leasing Company Accounting-Billing	80,86,68K	2,000	551
Government			
Famos Accounting	80,86,68K	650	64
Criterion Affirmative Action Planning	80,86		643
Criterion Manpower Planning	80,86	495	643
Criterion Municipal Planning Systm	80,86		643
Employee Disiplinary Tracking	80,86	495	643
Criterion Organizational Charting	80,86	695	643
Hotel Management			
Hotel - 2000	80	3,950-9,950	590
Insurance			
Homeowner Rate Calculation	80	400	35
B.O.P. Rate Calculations	80	600	35
INSYST	80	1,595	204
Automobile Rating-Insurance Policies	80,86	995	403

PROGRAM NAME	DOS	PRICE	VENDOR
INDUSTRY APPLICATIONS			
Automated Agency Accounting	80,86	995	403
HomeOwners Insurance Rating	80,86	995	403
Flexible Deposit Proposal Prep.	80,86,68K	1,000	551
VAAS	80,86	3,995	635
Insurance Auto Rating	80	600	35
Insurance Client Data Base	80	595	35
Insurance Agency Management System	80,86	2,500	279
Investment			
Income Property Analysis	80	1,995	360
Stock Management Package	80	39.95	98
Legal			
Legal Tender	80,86	950	27
Legal Client Mngr w/receivables	80,86	1,000	86
Personal Injury Litigation Support	80,86	4,000	129
Data Law System/3	80	4,000	151
Star System 5-Legal Tmkeepng-Bllng	80,86	950	536
Scheduler	80,86	995	358
ESQ-1	80,86	1,995	358
Law Office Management System	80,86	2,500	279
Legal Assistant	80	349	177
Laundry/Linen Supply			
Clean Ware-Software-Dry Cleaners	80	1,495	102
Laundry Route Accounting	80,86	3,500	303
Lumber			
Lumber Inventory	80,86	3,000	303
Manufacturing			
Manufacturing/ Inventory Control	80,86	2,500	279
MICROMRP][	80	495	179
Textile Manufacturing System	86	3,000-5,000	239
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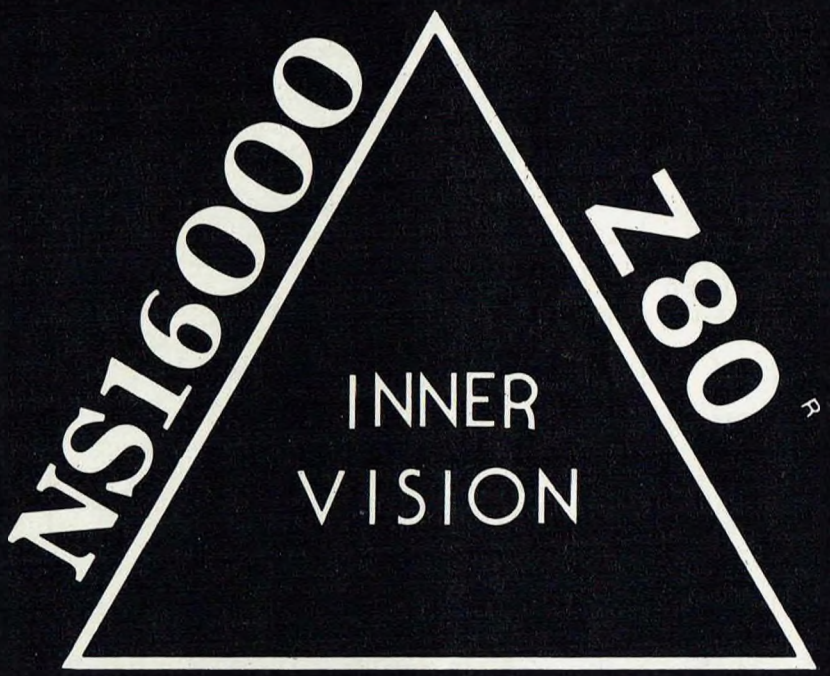
H-Store	80,86,68K	3,495	249
H-Buy	80,86,68K	2,495	249
H-Bomm	80,86,68K	1,495	249
Results	80	3,000	320



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Job Cost/Work-in-progress	80,86	600	348
Material Requirements Planning	80,86	600	348
IHMASS	80,86	600	348
Profitkey Mfg Control System	80,86	10,000-30,000	625
Jobshop	80,86	1,995	357
Profitkey Control System	80,86	10,000-30,000	302
MCS-3 Manufacturing Control System	80,86	1,200	359
Medical			
Dental Office Management	80,86	2,000	279
Medical Assistant	80,86	1,495	35
MicroMed	80,86	2,200-4,300	36
MicroMed (Multi-location)	80,86	2,800-4,900	36
MicroMed (Veterinary)	80,86	2,300-4,400	36
MicroMed (Chiropractic)	80,86	2,200-4,300	36
MicroMed (Radiology)	80,86	2,800-4,900	36
MicroMed (Anesthesiology)	80,86	3,000-5,100	36
Medical/Manager	80,86	1,500	134
Medical Accounting System	80,86	2,995	182
IMAGE-80	80	1,500	309
Blood & Organ Bank Systems	80,86,68K		499
MED-ACT	80,86	2,000	526
MED/TIPS	80,86,68K	2,500	551
Computer-Aided Logbook System Clinic	80	995	587
Computer Assisted Triage System	80	995	587
MD-REBS	80,86	5,000-8,000	624
PAS-3 Medical	80,86	995	628
S.A.I.L. Medical Management System	80,86	1,000	489
Medical Collection System	80,86	2,500	58
Medical Transportation System	80,86	2,500	58
Aton Medbil	80,86	2,000	390
The Physician's Office Computer	80,86	5,749	453
Nutrex	80	75	213
Patient Accounting System	80,86		458
Medical/Dental Office Mgnt System	80	3,000	646
MEDIC80	80	2,500-3,500	441

PROGRAM NAME	DOS	PRICE	VENDOR
INDUSTRY APPLICATIONS			
Medical Office Management System	80,86	2,000	279
Specialist	80,86	995-1,495	177
ADS Veterinarians	80	895	650
Membership Managmnt			
Members Only	80,86	950	27
Membership Billing	80,86	599.95	353
Church Directories	80,86,68K	250	82
Club Accounting System	80	250	491
Membership Management System	80,86	1,000	279
ADS Private Membership Clubs	80	895	650
Nursing Home			
Beechwood Nursing Home System	80		52
American Nursing Management	80,86,68K	1,995	28
Oil & Gas			
Pay Royalties	80,86,68K	50	81
Oil Operator Accounting/Reportng	80,86	3,495	48
The Station Master	80,86	1,000	540
Pension Management			
Pension Fund Accounting	80,86	2,000	303
Pharmacy			
Pharmacy Processing System	80,86	5,000	626
Universal Pharmacy Software Pkge	80,86	9,000-12,000	624
Economy Pharmacy Software	80,86	2,500	624
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The Professional	80,86	950	27
Eureka!	80,86	250	554
Snapshot System	80,86	995	58
B.I.S. "Time-Pak"	80,86	1,000-1,250	62
Professional TimeKeeping System	80,86	2,500	279
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Milestone	80,86	295	177
Monitor	80,86	495-895	84
Keystone Project Management Syst.	80,86	6,000	109
Projct Cst for Archtcts & Engnrs	80	1,495	360
PMS-II: Critical Path Prjct Mgmt	80,86,68K	1,295	413
B.I.S. Mnfg Prjct Mng System	80,86	9,000	62
Critical Path Project Mngmt-M2M	80,86	295	331

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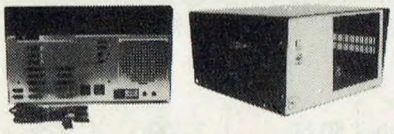

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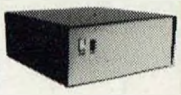

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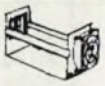

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2071/CC8-2	$120.00	2079/CC18-3	$240.00
		2080/CC22	$75.00

QT S-100 MOTHERBOARDS

•Silence Plus•Built In Termination•IEE696•Terminal strip for easy power connection

4 Slot Motherboards		**6 Slot Motherboards**	
2051/QTC-MB4BB	$15.00	2057/QTC-MB6BB	$20.00
2052/QTC-MB4A	$40.00	2058/QTC-MB6A	$48.00
8 Slot Motherboards		**12 Slot Motherboards**	
2053/QTC-MB8BB	$25.00	2059/QTC-MB12BB	$30.00
2054/QTC-MB8A	$69.00	2060/QTC-MB12A	$99.00
18 Slot Motherboards		**22 Slot Motherboards**	
2055/QTC-MB18BB	$45.00	2061/QTC-MB22BB	$60.00
2056/QTC-MB18A	$150.00	2062/QTC-MB22A	$185.00

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8026/Televideo 925C $715.00
8028/Televideo 970 ..... $1095.00
8013/Sanyo 2112A (15MHz) Green $80.00
8008/Princeton HX-12RGB (For IBM) $489.00

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•Provisions for 2 ea 8" thinline drives•15 ea DB 25 cutout •2 ea 50 pin•2 ea 34 pin•1 ea Centronic •EMI filter (fused)•2 AC outlets •Power supply (+ 8V16A/ – 5V/ + 24V6A + 5V6A)

7012/QTC-IMF + DD6F (6 slot MB) $350.00

DISK DRIVES

8" Disk Drives

5006/801R Shugart SS/DD $359.00
5007/851R Shugart DS/DD $479.00
5011/DT8 (842) Ourne DS/DD $490.00
BEST BUY 5014/M-2894-63 MIT DS/DD $389.00
(Call for qty price)
5016/M-2896-63 MIT 8" thinline DS/DD $399.00

5¼" Disk Drives

5018/TM100-1 or B-51 for IBM $150.00
5019/TM100-2 or B-52 for IBM (In stock) $225.00
5021/TM848-2 (DS/DD) $400.00

QT DISK DRIVE CABINETS

"All in One" Vertical Disk Drive Cabinet

For 1) 2 ea or 4 ea 8" thinline drive or 2 ea. std. 8" 2) 1 ea hard disk + 1 ea standard 8"
• Power supply (+ 5V6A/ – 5V1A/ + 24V6A)
• Positive pressure fan w/filter•EMI filter
• Power interface cable for any 8" drive

7001/QTC-DDC88V *For 2 standard size 8" drives* $269.00
7003/QTC-DDC88T *For 2 thinline 8" drives* $269.00
7005/QTC-DD8V *For 1 ea 8" drive* $249.00

For 2 ea 8" standard size drives (horizontal)
• Power supply (+ 5V6A/ – 5V1A/ + 24V6A)
• Interface cable for any 8" drive

7006/QTC-DDC88H $269.00

5¼" cabinets

7017/5¼" DDC5H w/PS horizontal-for 1-5¼" drive 55.00
7007/5¼" DDC5V w/PS vertical-for 1 ea. 5¼" drive 65.00
7008/5¼" DDC55V w/PS vertical-for 2-5¼ drives 85.00

MODEMS

0001/Hayes Smart 300 ..... 199.00
0002/Hayes Smart 1200 ..... 499.00
0003/Multi-Tech MT 212 AD (1200/300) 499.00
0004/Novation J-Cat 300 ..... 119.00
0005/U.S. Robotics 212A Auto Dial 469.00
0006/U.S. Robotics Password 399.00

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9152/Brother HR-1A (Par) 17CPS Daisy Wheel 595.00
9017/Dalsywriter 2000 (48K Buffer) 25 CPS Daisywheel 1,050.00
9048/Dynax-15 (Par) 13 CPS Daisywheel 475.00
Epson FX100 ..... Call
9051/C, I TOH Pro-writer 1 ..... 350.00
9062/Juki (Par) 18CPS Daisywheel 569.00
9066/Mannesman Tally (160CPS-40CPS) 589.00
9084/Oki-Data 82A (120CPS) 379.00
9086/Oki-Data 92 (160 CPS) 489.00
9088/Oki-Data 84P (200 CPS) 969.00
Star Gemini 10X and 15X ..... Call
9107/Toshiba P-1350 (192/120 CPS) 1,499.00

AC SURGE ELIMINATORS

0011/Grizzly (200W) uninterruptible power system + surge protection 750.00
0012/Grizzly (500W) uninterruptible power system + surge protection 1,802.00
0013/Hawk AC power monitor w/surge protection 160.41
0014/Lemon (6AC outlets-3 prong) 44.00
0015/Lime (5'-3 prong pwr cord w/on-off switch 69.00
0016/Orange-AC surge + EMI filter (6 outlets) 95.00
0017/Peach (3 outlets) 69.00

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2001/20 Slot MB	225.00	2014/Interfacer 4	314.00
2002/CPU 8085/88	349.00	2015/System Support I	308.00
2003/CPU 8086/8087	550.00	2016/Active Terminator	65.00
2004/Disk I	399.00	2017/Enclosure 2	
2005/CPM 2.2 for Disk I	150.00	(Desk)	725.00
2006/Disk II	610.00	2018/Enclosure 2	
2007/Ram 16-64K	325.00	(Rack MT)	775.00
2008/Ram 17-64K	299.00	2019/CPU-Z	228.00
2009/Ram 21-128K	650.00	2020/M-Drive H	1,229.00
2011/Interfacer 1	198.00	2021/8 Slot MB	125.00
2012/Interfacer 2	249.00	2022/12 Slot MB	155.00
2013/Interfacer 3	515.00	2023/CPU 68K	510.00

SIERRA DATA S-100 BOARDS

2030/SDS-SBC-100-Z80 (4mhz) master 2 serial 2 par/floppy controller/64k ram $855.00
2031/SDS-SBC-100S4mhs slave/2 serial 2 par/64k ram $565.00
2032/SDS-ZSIO/4-4 serial port I/O bd $250.00
2033/SDS-MUX-RS232 multiplexer bd $235.00
2034/SDS-HDI-M-Hard disk bd for micropolis $129.00
2035/SDS-CPM/B105-cp/m for SBC100 w/BIOS $150.00
2036/SDS-Turbodos-Multi-user for master & slaves $645.00

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QTC-FDC 5/8 Floppy disk controller
Bare Board Set $150.00
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2) Parts available 3) Monitor & B10S available

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S-100•Time in hrs, min, sec.•AM/PM or Military Format•Date in Mo., Day, Yr, Day of Week & Leap Year recognition•4 hard interrupts (1024 Hz, 1 Hz, 1 min, 1 hr) • On board battery (will last 14 mos. w/no power on)

2049/QTC-CCS-BB (S-100) $45.00
2050/QTC-CCS-A (A + T) for S-100 ..... $95.00

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2038/QTC-SBC 2/4 BB (SBC880) $50.00
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2040/QTC-Z + 80 BB (BIG Z) $28.00

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2041/QTC-EXP + III Bare Bd. (CT256) $75.00
2042/QTC-EXP + III 64K A + T (CT256) $375.00

2043/QTC-I/O + BB *2 SER 2 PAR* A + T $75.00
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MICROSYSTEMS CP/M SOFTWARE DIRECTORY

PROGRAM NAME	DOS	PRICE	VENDOR
INDUSTRY APPLICATIONS			
Easi Path "1"	80,86	200	195
Easi Path "2"	80,86	200	195
Target Task	80	329	649
Property Management			
Property Management	80,86	695	67
Property Management	80,86	450	476
Star System 7-Property Management	80,86	950	536
DEPREC18	80	85	163
Advanced Commercial Propty Management	80,86	1,495	46
Advanced Apartment Management	80,86	1,495	46
Milestone	80,86	295	177
Publishing			
Publiphile Subscrptn Mngmnt System	80,86	1,450-2,450	615
Restaurant			
Restaurant Payroll	80,86	499.95	353
microCellarMaster	80,86,68K	750-1,500	297
Retail			
Gina	80,86	295	554
Flex PManager Retail Invtry Cntrl	80,86	2,995	447
Desktop Inventory Manager	80	295	483
ADS Retail Florists	80	895	650
Real Estate Office			
Loan Sales/Purchase	80,86	50	476
APR Loan Analysis	80,86	50	476
Tax Deferred Exchange Analysis	80,86	50	476
Income Property Analysis	80,86	50	476
Property Sales	80,86	50	476
Loan Amortization Schedule	80,86	50	476
Home Purchase	80,86	50	476
Construction Cost/Profit	80,86	50	476
Depreciation/ACRS	80,86	50	476
Property Listing + Comparables	80,86	325	476
Reily	80,86	595	198
Mortgage Loan Servicing	80,86	3,495	645
School			
School Administration	80,86	3,000	279
Spec. Ed. Admnstrtv.-Pupil Trackng	80	2,995	333
Measurements	80	75	481
Computer Aided Instruction	80	34.95	481
Datalaoc Private School	80,86	2,500	156
Special Education	80	2,495	642

PROGRAM NAME	DOS	PRICE	VENDOR
INDUSTRY APPLICATIONS			
Supervisor			
FUNZEEZ	80	75	481
Student RecordKeeping System	80,86	1,000	279
Sports			
Scorekeeper	80,86	49-495	386
Utility Billing			
Utility Billing	80,86	699.95	353
Cable TV Billing and Accnts Recbl	80,86	1,495	303
Wholesale Distributor			
Wholesale Distribution	80,86	2,500	279
Wholesale Distributor	80,86	3,500	303
American Plastics Distributor	80,86,68K	2,495	28
Other			
Church Manager	80,86	299-999	35
Insurance Client Data Base	80	595	35
Insurance Auto Rating	80	600	35
Hospital Physicns Log-in Message Center	80,86	750	86
Hospital Intergrated System	80,86	2,500	86
Hospital PBX Patient Lookup	80,86	350	86
Hospital Patient Management Pgrm	80,86	750	86
P.A.A.D. Profess. Actng for Amway	80,86	3,000	129
Reservation Manager	80,86	250-350	129
Tape Manager	80,86	1,000	129
ZooLogical	80,86	5,000	129
Reliability Prediction Program	80	950	201
CBIS/FP	80	9,625	263
Hatchery/Poultry Farm Accounting	80,86	2,500	311
Comm. & Installment Loan Processng	80,86	2,500	311
Multi-State Fuel Tax Report-Trucking	80,86	995	403
Church Management	80,86	995	403
The Resume Bank	80,86	350	554
Proper	80	995	575
Pest Control Management System	80,86	5,000	627
Security Management System	80,86	1,500	627
Church Management System	80,86	2,500	627
MicroVet	80,86	1,500	628
Certified Enviro Plus	80,86	5,995	629
Purchasing	80,86		348
County Fundig w/AR, AP, GL	80,86	1,495	86
Construction Estimates	80	29.95	98

PROGRAM NAME	DOS	PRICE	VENDOR
INDUSTRY APPLICATIONS			
COMTAS	80,86	5,600	58
Escrow Accounting	80,86	2,800	58
Record and Tape Warehousing	80,86	6,200	58
B.I.S. Numismatic Auction Package	80,86	2,000-6,000	62
Sales-Rep	80,86	3,495	205
A/C Contractor System	80,86	4,000	390
Church Management	80,86	2,500	279
Student Recordkeeping	80,86	1,000	279
Fund Accounting System	80,86	650	279
ADS Churches	80	895	650
ADS Residential/ Commercial Servcs	80	895	650
OPERATING SYSTEMS			
Operating System			
CP/M 2.2	80		276
CP/M Plus	80		176
CP/M-86	86		176
CP/M-68K	68K		176
CP/M	80	295	153
CP/M 8-16	80,86	450	96
MP/M 8-16	80,86	1,000	96
MP/M-80	80		176
MP/M-86	86		176
Micronix	80		401
Oasis	80,86		443
Superbrain Operating System	80	125	153
NBASIC	80	80	117
S.E.A.S.	80	70	489
DPC/OS 3.0	80	595	9
P&T CP/M 2	80	200-250	445
AMX Multitasking Executive	80	800	298
CHIRO80	80	2,500-3,500	441
Bank Swc CP/M 2.2 Rad Shk II/12/16	80	259	43
CP/M 2.2 for Radio Shack II/12/16	80	199	43
CP/M 2.2-Radio Shack-hard disk	80	279	43
dpc/os	80,86	595	9
ZRIMOS	80	40	32
TPM-I	80	80	656
TPM-II	80	125	656
MSPRO	86	395	663
CP/M (SSIOBus)	80	595	675
System Utility			
Keymaster	80	59.95	115
Power!	80,86	169	120
Menu!	80,86	149	120
Unera	80	29	92
Disk Utility Package	80	125	199
P-File	80	129.95	200
PDIR	80	15	201

PROGRAM NAME	DOS	PRICE	VENDOR
OPERATING SYSTEMS			
Bakup	80	49.95	217
Utility II	80	24.95	217
Disk Fix Disk Editor & Recovery	80	150	520
Pack N'Crypt	80	24.95	521
Autodiff File Differencer	80	29.95	521
Super Zap Disk Dump/Patch	80	24.95	521
Recover File Recovery System	80,86	75	528
Startjob	80	29.95-150	553
ZAP-80	80	29.95	553
C-PACK	80	19	603
View-CP/M Disk Block Editor	80	39	603
ICX ISIS-CP/M Exchanger	80	89	603
Bobcat Catalog Program	80	25	472
DirectoryDriver	80	69	187
FileDriver	80,86	69	187
Extend	80	110	117
Command	80	25	117
View	80	29.95	253
MicroTools	80	150	408
Backup-Restore for Hard Disk	80	99	390
Auto-Backup & Catalog	80,86	99-750	524
Programmer's Utilities	80,86	99-750	524
Keychanger	80	46.50	112
Computer Code Clerk	80,86,68K	29 +	641
Runpac/Z	80	95	642
Runpac86	86	145	642
Runpac80	80	80	642
Hexcom	80	80	642
Software Anthology Series 1-4	80	32.50	614
ISIS-CP/M	80	250	529
Bridge	80	69.50	614
Transport	80	69.50	614
Bobcat	80	25	472
Cache/Q	80,86		667
Software Tools Pkg	80	25	670
File Encryptor	80	25	670
QBAX (Backup)	80	30	672
System Extension			
XSUB for CP/M-86	86	33.95	199
BLAZE/LIB	80	75-200	538
ISE-Isis Emulator	80	89	603
The CP/M Connection	80		204
Menu +	80	29.95	253
Dynashell	80	45	649
System Enhancement			
Talisman	80,86	125	183
DMM-1 Software Utilities	80	35	201
IBIOS	80	19.95	397
BLAZE/IO	80	75	538

MICROSYSTEMS CP/M SOFTWARE DIRECTORY

PROGRAM NAME	DOS	PRICE	VENDOR
OPERATING SYSTEMS			
MicroShell	80	150	408
P&T ACP	80	85	445
Portable Software Toolkit	80,86,68K	200	605
SmartKey	80		250
SmartScreen	80		250
UNICA	80	195	307
RCCP	80	79.95	588
SCP/80	80	100	671
Okara	80	39.95	674
Print Spooler			
P-Spool	80	99	200
Spooler	80	95	305
VSPOOL	80	79	122
SPL	80	139	55
Spool	80		250
SOFTWARE DEVELOPMENT			
Development System			
Application Development Util	80	495	234
Wiremaster	80,86	195	132
MegaBasic Softwr. Devel. System	80,86	400	29
Application Development Software	80	495	234
General Subroutine	80	295	234
Z8000 Forth Development System	80,68K	450	268
Janus/Ada	80,86	500	487
Macro Assembler Package	80	200	383
PDS Program Development System	80	99	39
Code Translator			
8080/Z80 to Z80 Code Translator	80,86	179.50	1
8080/Z80 to 8086 Code Translator	80,86	179.50	1
TransForm	80	39.95	326
ITOZ/ZTO1	80	40	475
Z80/8086-8088 Cross Assembler	80	95	494
ISIS	80	250	529
Z80 to 8080 Source Code Transltr	80	49	43
8080 to Z80 Source Code Transltr	80	49	
Magic/2	68K	295	660
Cross-Assembler			
INTEL 8085 Cross Assembler	80	75	394
8086 Relocating Macro Cross Assem.	80	179.50	1
XASMO5	80,86	200-250	50
XASMO9	80,86	200-250	50
XASM18	80,86	200-250	50

PROGRAM NAME	DOS	PRICE	VENDOR
SOFTWARE DEVELOPMENT			
XASM48	80,86	200-250	50
XASM51	80,86	200-250	50
XASM65	80,86	200-250	50
XASM68	80,86	200-250	50
XASMF8	80,86	200-250	50
XASMZ	80,86	200-250	50
XASM400	80,86	200-250	50
XASM75	80,86	200-350	50
XMAC68K	80,86		50
Z8000 Macro-Cross Assembler	80,86	179.50	1
6809 Relocating Macro-Cross Assem.	80,86		1
6800 Relocating Macro-Cross Assem.	80,86		1
8748 Relocating Macro Cross Assem.	80,86	79.50	1
6502 Relocating Macro-Cross Assem.	80,86	79.50	1
Z8 Relocating Macro-Cross Assem.	80,86	79.50	1
Z80 Macro-Cross Assembler	80	79.50	1
Kros & Klink	86	200	308
Intel 8041,8741 Cross Assembler	86	300	394
Intel 8035,8048,8748 Cross Assmblr	86	300	394
Intel 8054 Cross Assembler	80	200	394
Motorola 6800,6802 Cross Assembler	86	300	394
Motorola 6801,6803 Cross Assembler	86	300	394
Motorola 6805 Cross Assembler	86	300	394
Motorola 6809 Cross Assembler	86	300	394
RCA COSMAC Cross Assembler	80	200	394
Zilog Z-80 Cross Assembler	80	75	394
National SC/MP Cross Assembler	80	200	394
Mostek 387X/F8 Cross Assembler	80	200	394
Synertek 6502 Cross Assembler	86	300	394
Intel 8085 Cross Assembler	80	200	394
Intel 8041,8741 Cross Assembler	86	300	394
Intel 8035,8748 Cross Assembler	86	300	394
Intel 8051 Cross Assembler	86	300	394
Motorola 6800,6802 Cross Assembler	80	200	394
Motorola 6801,6803 Cross Assembler	80	200	394
Motorola 6805 Cross Assembler	80	200	394

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SOFTWARE DEVELOPMENT

PROGRAM NAME	DOS	PRICE	VENDOR
Motorola 6809 Cross Assembler	80	200	394
RCA COSMAC/1802 Cross Assembler	86	300	394
Zilog Z-80 Cross Assembler	86	200	394
National SC/MP Cross Assembler	86	300	394
Mostek 387X/F8 Cross Assembler	86	300	394
Synertek 6502 Cross Assembler	80	200	394
AGENS	80	170	474
8086-8088 Translator	80	95	494
ZAS Z-8000 Software Devlmt Pck	80	395	603
XRMAK-F8	80	250	39
XRMAK-18	80	250	39
XRMAK-Z8	80	250	39
System-20	80	150	39
System-70	80	150	39
System-CP4	80	150	39
System 3870	80	150	39
System-18	80	150	39
System-Z8	80	150	39
System-75	80	150	39
System-51	80	150	39
System-48	80	150	39
System-99	80	150	39
System-320	80	150	39
System-TMS-7	80	150	39
Intel 8035,8048,8748 Cross Assmblr	80	200	394
Intel 8051 Cross Assembler	80	200	394
6502 Cross Assembler	80	150	656
Cross Compiler			
Aztec Cross Compilers	80	500-2,000	322
MetaForth Cross Compiler	80,68K	450	268
PLMZ	80	500	552
DMA "C"	80	295	192
ZDM/ZDMZ	80	50	475
Pascal Compilers and Cross Support	80,86,68K	700-1,400	605
Debugger			
Raid Real-Time Assembly Debugger	80,86	250	529
Raid	80	250-695	528
Radar	80	495	528
dutil	80,86	99	231
Disk-Edit	80,86	100	548
SID	80,86		176
XDT-Interactive Z80 Debugger	80	49	43
Debug I	80		656
Debug II	80	100	656
ZDDT	80	40	656

SOFTWARE DEVELOPMENT

PROGRAM NAME	DOS	PRICE	VENDOR
Assembler			
Z80 Relocating Macro-Assembler	80	49.50	1
8086 Relocating Macro-Assembler	86	79.50	1
RMAC	80		176
Smal/80 for 8080, 8085,Z80	80	175	80
Z80MAC	80	100	304
Z80ASM	80	50	304
A68K	80,86	300	468
UVMAC Macro Assembler 8080	80	29.95	521
UVMAC Macro Assembler Z80	80	29.95	521
RCA 1802 Assembler (Macro-18)	80	250	552
Motorola 6800 Assembler (Macro-68)	80	250	552
Microsoft Macro-80	80	250	552
Z80ASM & SLRNK	80	169.96	634
Macro I	80	80	656
Macro II	80	150	656
Macro III	80	152	656
Linker	80	80	656
QSAL Assembler	80	200	656
Loader			
Lynx	80	250	478
Program Generator			
PScreen	80	50	32
Panel - Screen Design Aid	80,86	350	486
QuickCode	80,86	295	231
Other			
G7128 EPROM Programmer	80,86	389	50
BASXREF	80,86	39	92
CB80 Language Utilities	80	99	200
CP/M & SIG/M	80	10	201
HDIS	80	85	201
SIM80/SIM Z80	86	170	308
KDIS 86	86	170	308
Ci-C86 C Compiler	86	395	108
Omega	80	150	117
MXREF	80	96	117
Revas	80	90	482
Structured Basic Preprocessor	80,86	39	390
CMWC-86 for CP/M	86	495	606
Information Access	80	375	439
Menu Master	80,86	195	637
EPROM Programming Monitor	80	75	147
BLX	80,86	95	468
Unprotect Basic Source Recovery Libraries	80	70	555
	80,86,68K		605

MICROSYSTEMS CP/M SOFTWARE DIRECTORY

PROGRAM NAME	DOS	PRICE	VENDOR
SOFTWARE DEVELOPMENT			
Zapple Monitor	80	80	656
Disassembler	80	80	656
Compare II	80,86	145	666
LANGUAGES			
ADA			
Augusta	80	90	310
Ada	80	300	548
APL			
SOFTRONICS APL	80	180	510
APL (& DATAB)	80	350	510
APL	80,86	300	22
Basic			
CBasic	80,86		176
TRSDOS Basic with CP/M Support Pkg	80	99	43
EBasic with Starbase 3.2	80,86	29.95	191
Tarbell Disk Basic	80	200	201
Program Map Basic Cr/Ref Utility	80	150	520
S.A.I.L.B.O.A.T.	80,86	70	489
Microsoft Basic Compiler	80	395	382
Basic	86	300	548
COMAL-80	80	250	338
BASIC/Z Single/Multiuser Compiler	80,86	345	555
ZCOM Complr-Micro Mike's BaZic-08	80	200	39
Basic-I	80	50	656
Basic-II	80	100	656
Business Basic	80	200	656
Basic	68K		658
CB-80 Software	80		665
C			
C' (C-prime)	80	500	352
C/80 3.0 Compiler	80	49.95	521
BDS C Compiler V.1.5	80	130	614
Q/C Compiler	80	95	85
Microsoft Basic Interpreter	80	350	383
C Compiler	80,86	275-500	548
C Compilers & C Cross Compilers	80,86	350	573
Small-C Compiler	80	19.95	85
Aztec C65	80	199	322
Aztec C86	86	249	322
Aztec CII	80	199	322
Scan (North Star Basic)	80	29.95	207
Renumber (North Star Basic)	80	39.95	207
Tiny C	80		583
BDS-C	80	150	652
C-Compiler	80,86	195	654
C-Window	80,86	195	654
BDS-C	80	140	657

PROGRAM NAME	DOS	PRICE	VENDOR
LANGUAGES			
DDS-C Floating Point Package	80		657
CAI			
EMCEE	80,86	150	554
Cobol			
Cobol	80	750	405
Nevada Cobol	80	29.95	202
RM/Cobol	80,86	750-1,250	488
RM/Cobol	80	750	405
Microsoft Cobol Compiler	80	750	383
Forth			
Dynaforth	80,86	74.95	191
PC/Forth	86	100	310
Z80 Forth	80	50	310
8086 Forth	86	100	310
68000 Forth	68K	250	310
Uniforth	80,86,68K	60-500	589
Timin Dual Tasking Forth	80	239.95	582
Timin ROMable Forth	80	199.95	582
Timin Forth Release 3.1	80	99.95	582
SSS-Fortran-86	86		9
FIG-FORTH w/ Full Screen Editor	80	50	33
Forth	80	200	548
MVP-Forth Programmer's Kit	80,86	150	404
VME-Forth	68K	69	147
UniForth	80	35	589
68K Forth	68K		658
Forth-79	80	99.95	673
Forth-79 Floating Point Package	80	99.95	673
Fortran			
Nevada Fortran	80	29.95	202
Ratfor Structure Fortran	80	39.95	521
Ratfor	80,86	139	42
Microsoft Fortran 80 Compiler	80	500	383
Pro Fortran	80,86	350	461
Fortran	80,86	425	548
Lisp			
Lisp/80 Interpreter	80	39.95	521
mLisp	80	200	507
Microsoft	80	200	383
Pascal			
UCSD Pascal	80,86		509
JRT Pascal	80,86	100	296
Pascal Primer	80	64.50	614
Pascal 12	80	450	631
Pascal/Z & Pascal BZ	80	450	286
Pro Pascal	80,86	350	461
Turbo Pascal	80,86	49.95	637

MICROSYSTEMS CP/M SOFTWARE DIRECTORY

PROGRAM NAME	DOS	PRICE	VENDOR
LANGUAGES			
Other			
Dr. Logo	86		176
PL/I	80,86		176
Nevada Pilot	80	29.95	202
dux-AFL	86	450	308
SAL/86	86	99	462
SAL/80 Version 3.0	80	79	462
ANSI MUMPS	80,86	55	600
Z80 Emulator	68K		658
Sim 80	86	50	661
UTILITIES			
Hardware Diagnostics			
Memtest/86	86	29	462
Memtest/80	80	29	462
Diagnostics II	80,86	125	548
Badlim	80	73	55
CP/M.D.	80	29.95	668
Math Routines			
Math Pack	80	100	243
Floating Point Processor	80,86	500	528
Trig-Pac	80,86		528
Trig-Pac	80	250-300	528
FPP	80	500-2,500	528
Floating Point	80	95	552
Math Package for Pascal/Z	80	50	60
Development Utilities	80	100	39
Floating Point Math Pckg-Pascal/Z	80	85	60
Other			
Undelete Erased File Recovery	80	45	555
dataCure	80	100	87
Keychanger	80	49.50	112
DPatch	80	195	14
Filer	80	49	92
UNE/CON	80	75	201
Jools	80	95	201
Wash	80	49	201
Programmer's Helper	80	15	201
(Admin) Remote Administrator	80,86	600	219
(Remote) Remote End Use Node	80,86	60	219
Organizer II	80,86	149	265
Isis-CP/M Conversion Utilities	80,86	250-500	528
Catalog V4.31	80	75	533
DTS-3	80	250	624
Eureka!	80	50	335
Get/Put-CP/M to/from TRS-DOS	80	100	520
BackRest	80,86	99.95	541
Anthology	80	99	187
Reformatter	86	350	389
XFER	80,86	25	116
Sort, Base Cnvsn, Metric Cnvsn	80	19.95	98

PROGRAM NAME	DOS	PRICE	VENDOR
UTILITIES			
TVSet	80	75	408
MicroCrypt	80	125	408
Disk Maker I	80	1,200	408
Microsoft Sort Facility	80	195	383
O.S. Converter Convms	86	95	192
EM80/86	86	95	192
Compat	80	99.95	537
Timin Forth Application Modules	80	59.95	582
Disk Doctor	80,86	100	548
Intel to CP/M Transfer	80	95	147
EPROM Programming Monitor	80	45	147
CPMUG Index Guide	80	19.95	582
CP/M-MP/M Utilities	80	29.95	679
Menu-Plus	80	29.95	682
Micro-WYL	80	29.95	682
WSMX 80	80	29.95	682
Disk Inspector	80	29.95	682
Resident Console Command Processor	80	79.95	683
Math Processor for AM9511 chip	80	59.95	683
Bill of Material Processor	80	595	683
Accounts Payable	80	595	683
General Ledger	80	340	683
Shortax +	80	495	692
Bobcat	80	25	691
Integrated Accounting System	80,86,68K	450	690
Gold Series II-Business Applications	80,86	695	689
Gold 24-Business Applications Software	80	1,195	689
Silversoft	86	395	689
MLIB	80	75	688
LCOPY	80	40	688
MAXFONT	80	40	688
MAX DISK	80	20	688
SFP	86	35	687
CAP	86	35	687
SIG	86	35	687
dGRAPH	80	295	686
QuickCode	80	295	686
dUTIL	80	99	686
RM/COS	80	1,500	488
RM/Fortran	80	950-1,250	488
PC Generator	86	400	685
Property Management System	80	1,200	685
Programmer's Apprentice	80	495	685
Software Production Lab	80,86	195	685

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8086/88 XASM	$179.50	$750.00			$179.50
Z-8000 ASM		750.00			299.00
Z-8000 XASM	179.50		179.50	179.50	
Z-80 ASM	49.50				
Z-80 XASM		500.00	79.50	79.50	79.50
Z-8 XASM	79.50	500.00	79.50	79.50	79.50
6502 XASM	79.50	500.00	79.50	79.50	79.50
6800,2,8 XASM	79.50	500.00	79.50	79.50	79.50
6801,03 XASM	79.50	500.00	79.50	79.50	79.50
6805 XASM	79.50	500.00	79.50	79.50	79.50
6809 XASM	99.50	600.00	99.50	99.50	99.50
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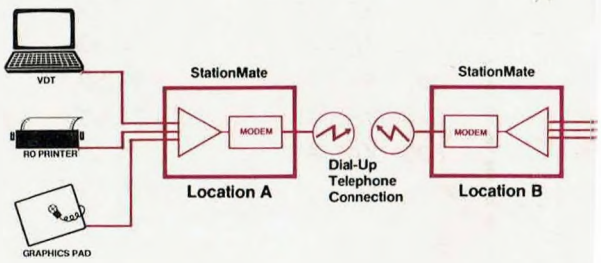

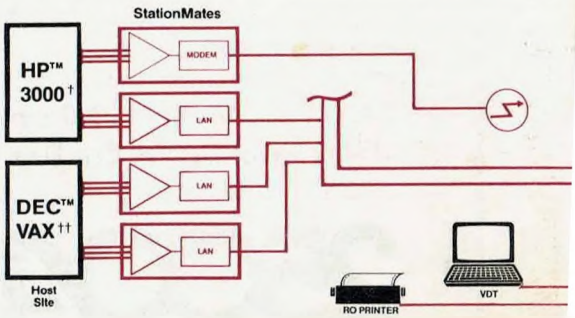

Local Networking

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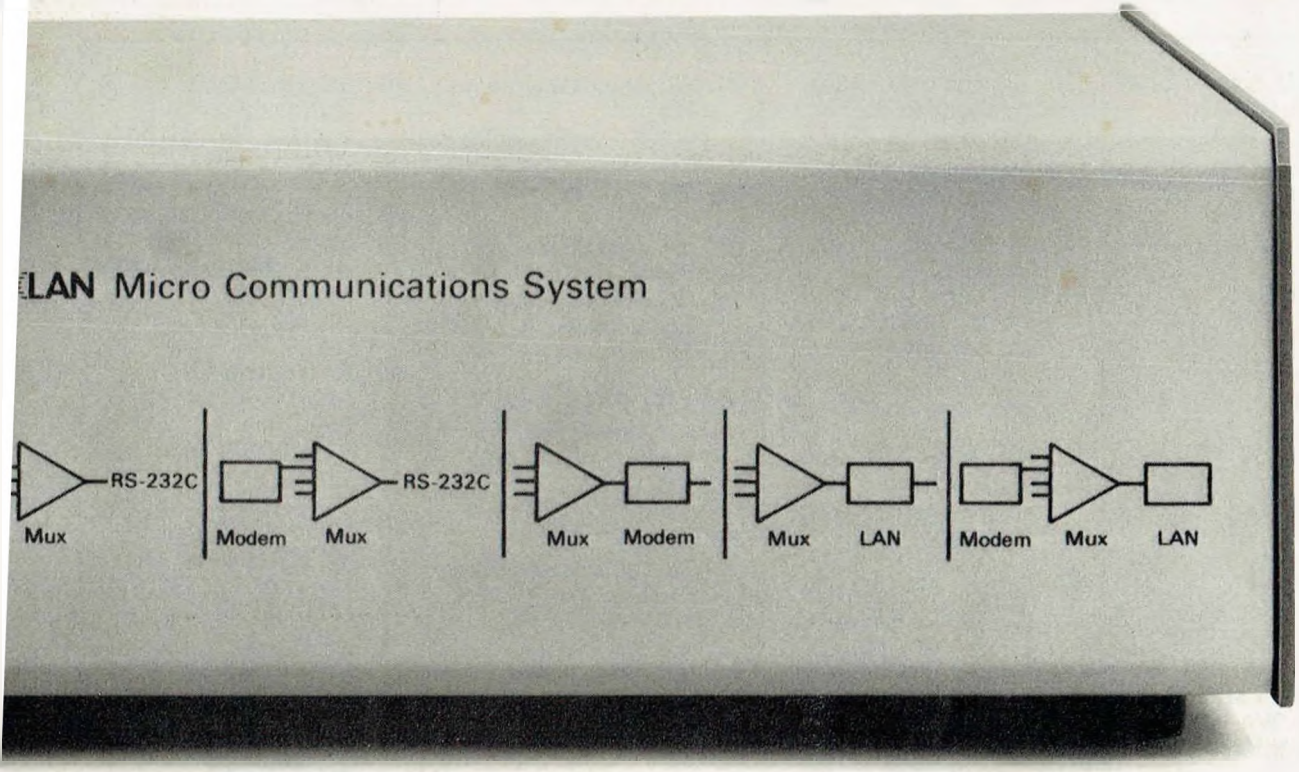

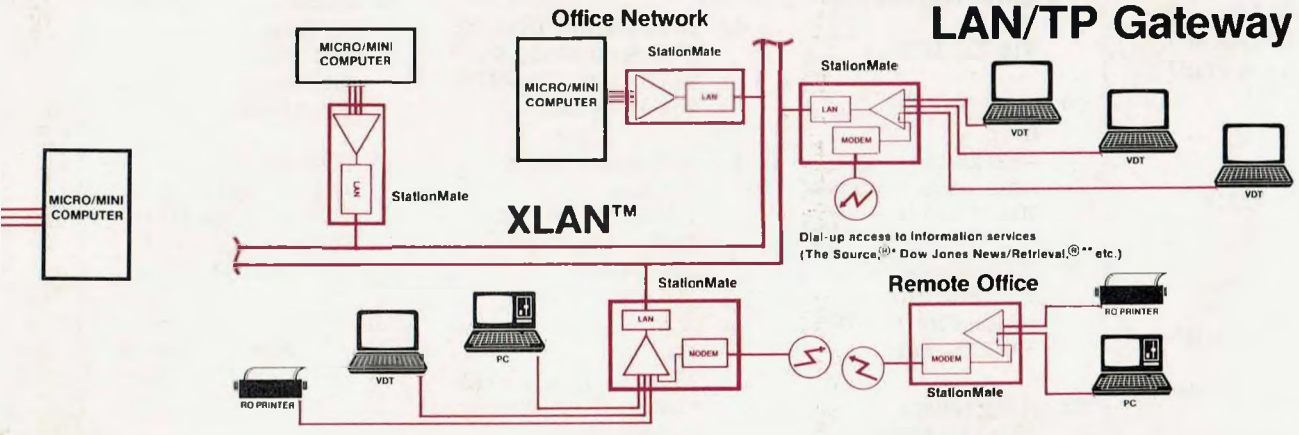

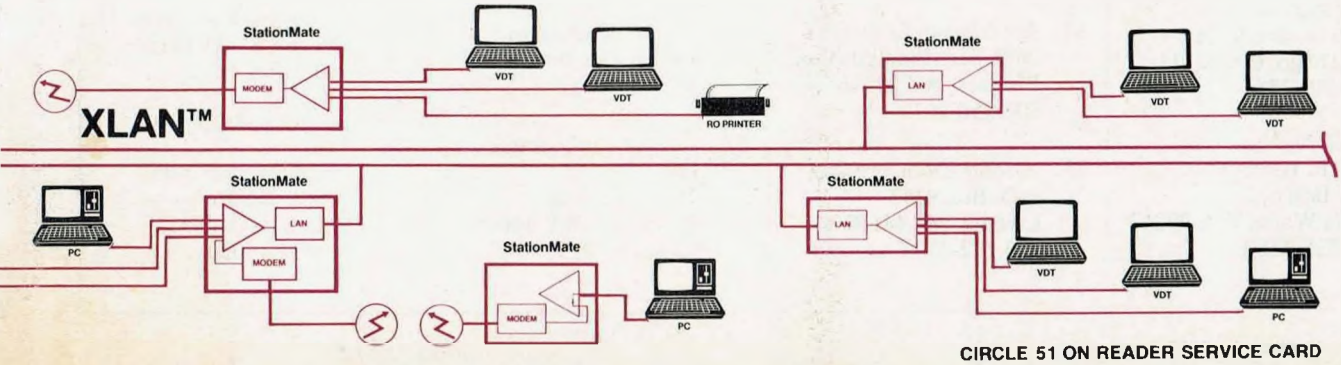

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CP/M Software Vendors (Primary Sources)

1 2500 A.D. Software, Inc.
17200 E. Ohio Dr.
Aurora, CO 80017
303-752-4382

2 2M Corp.
3 Astro Place, P.O. Box 8
Denville, NJ 07834
201-625-8100

4 A/N Software
P.O. Box 895
Melville, NY 11747
516-549-4090

6 ABS Software
1780 Austin Highway
San Antonio, TX 78218
512-224-4802

7 Accountants Microsystems
3363 136 P1 SE
Bellevue, WA 98006
206-643-2050

9 Action Computer Enterprise, Inc.
430 N. Halstead St.
Pasadena, CA 91107
213-351-5451

12 ADI
17192 Gillette
Irvine, CA 92714
714-545-3732

14 Advanced Micro Techniques
1291 E. Hillsdale Blvd., #209
Foster City, CA 94404
415-349-9336

17 Afterthought Engineering
7266 Courtney Dr.
San Diego, CA 92111
619-279-2868

18 Ag-Data, Inc.
3031 E. Issacs Ave.
P.O. Box 672
Walla Walla, WA 99362
509-525-2580

21 Agricultural Computer Applications, Inc.
P.O. Box 8
Davis, CA 95617
916-756-8946

24 American Business Systems, Inc.
3 Littleton Rd.
Westford, MA 01886
617-692-2600

25 American Computers & Engineers
2001 S. Barrington Ave., #204
Los Angeles, CA 90025
213-477-6751

27 American CompuSoft
23113 Plaza Pointe Dr.
Laguna Hills, CA 92653
714-472-8186

28 American Data, Inc.
8084 Old Auburn Rd., #D
Citrus Heights, CA 95610
916-722-1125

29 American Planning Corp.
4600 Duke St., #423
Alexandria, VA 22304
703-751-2574

30 Anderson-Bell Co.
P.O. Box 191
Canon City, CO 81212
303-275-1661

32 Aries Software
19787 La Mar Dr.
Cupertino, CA 95014

33 Aristotelian Logicians
2631 East Pinchot Ave.
Phoenix, AZ 85016
602-956-7678

35 Artcom Data Services
P.O. Box 9343
Livonia, MI 48150
313-522-3377

36 Articulate Publications, Inc.
402 N. Larchmont Blvd.
Los Angeles, CA 90004
213-871-1350

37 Artificial Inteligence Research Group
921 North La Jolla Ave.
Los Angeles, CA 90046
213-656-7368

38 ADS Software, Inc.
707 Fifth St., NE
Roanoke, VA 24016
703-344-6818

39 Ashley, Allen
395 Sierra Madre Villa
Pasadena, CA 91107
213-793-5748

41 Ask Micro Software Division
100 Blue Ravine Rd.
Folsom, CA 95630
916-985-6555

43 Aton International, Inc.
1765 Scott Blvd., #119
Santa Clara, CA 95050
408-554-9922

46 Automated Realty Systems
13140 Coit Rd., #212
Dallas, TX 75240
214-680-0613

48 Automated Oil Systems, Co.
13140 Coit Rd., #212
Dallas, TX 75240
214-680-0613

50 Avocet Systems, Inc.
804 South State St.
Dover, DE 19901
302-734-0151

52 Beechwood Software, Inc.
34 Macbeth St.
Rochester, NY 14609
800-828-1493

55 Blat R&D Corp.
8016 188th St. SW
Edmonds, WA 98020
206-771-1408

58 Brenco Computer Systems
200 N. White Horse Pike
Somerdale, NJ 08083
609-783-1336

60 Brom Microsystems Engineering, Inc.
Box 616
Winona, MN 55987
507-452-5805

62 Budget InfoSystems
607 NE Highway 10
Blaine, MN 55434
612-780-5361

63 Business Application Software
16755 Littlefield Lane
Los Gatos, CA 95030
408-356-7782

64 Business Information Associates
P.O. Box 225
Glen Echo, MD 20812
301-229-6819

67 Business Solutions
46 E Herbert Ave.
Salt Lake City, UT 84111
801-531-8844

73 Casheab
5737 Avenida Sanchez
San Diego, CA 92124
619-277-2547

74 Cawthon Scientific Group
24224 Michigan Ave.
Dearborn, MI 48124
313-565-4000

78 Chang Laboratories, Inc.
5300 Stevens Creek Blvd., #200
San Jose, CA 95129
408-246-8020

80 Chromod Assoc.
1030 Park Ave.
Hoboken, NJ 07030
201-653-7615

81 Chuck Atkinson Programs
Rt. 5, Box 277-C
Fort Worth, TX 76126
817-249-0166

82 Church Software
2797 Alton Lane
Santa Rosa, CA 95402
707-527-5880

83 Clear Systems
309 Santa Monica Blvd., #404
Santa Monica, CA 90401
213-394-7740

84 Clements Co., The
936 Alice Lane
Menlo Park, CA 94025
415-321-1617

85 Code Works
5266 Hollister, #224
Santa Barbara, CA 93160
805-683-1585

86 Codedata, Inc.
608 Grand Ave.
Arlington, TX 76010
817-274-4262

87 Colorado Online
40 Balfour Lane
Ramsey, NJ 07446
201-327-5155

89 Commsoft
2452 Embarcadero Way
Palo Alto, CA 94303
415-493-2184

90 Communications Research Group
8939 Jefferson Highway
Baton Rouge, LA 70809
504-923-0888

92 Compu-Draw
1227 Goler House
Rochester, NY 14620
716-454-3188

93 Compucraft
5506 Nagle Ave.
Van Nuys, CA 91401
213-994-5595

95 CompuMax, Inc.
Box 7239
Menlo Park, CA 94025
415-854-6700

96 CompuPro
3506 Breakwater Court
Hayward, CA 94545
415-786-0909

98 Comput-R-Systems
10818 Brentwary Dr.
Houston, TX 77070
713-469-2584

102 Computer Business Systems
3350 N. Green River Rd.
Evansville, IN 47715
812-473-1081

103 Computer Control Systems, Inc.
298 21st Terr. SE
Largo, FL 33541
813-586-1886

104 Computer Corner
807 Monogahela Building
Morgantown, WV 26505
304-292-9700

106 Computer EdiType Systems
509 Cathedral Parkway
New York, NY 10025
212-222-8148

107 Computer Headware
Box 14694
San Francisco, CA 94114
415-647-8518

108 Computer Innovations, Inc.
10 Mechanic St.
Red Bank, NJ 07701
201-530-0995

109 Computer Management Advisors
235 S. Maitland Ave.
Maitland, FL 32751
305-628-1832

112 Computer Publishing Co.
1945 North Fine, #101
Fresno, CA 93727
209-453-0777

113 Computer Products Intl.
3225 Danny Park.
New Orleans, LA 70002
504-455-5330

115 Computer Shop
283 Medford Ave.
Patchogue, NY 11772
516-758-6558

117 Computer Toolbox, Inc.
1325 East Main St.
Waterbury, CT 06705
203-754-4197

120 Computing!
2519 Greenwich St
San Francisco, CA 94123
415-567-1634

122 Compuview Products, Inc.
1955 Pauline Blvd, #200
Ann Arbor, MI 48103
313-996-1299

125 Construction Data Control Inc.
6140 Northbelt Pkwy, #A
Norcross, GA 30071
404-448-4722

127 Continental Software
11223 S. Hindry Ave.
Los Angeles, CA 9045
213-410-3977

129 Core Software
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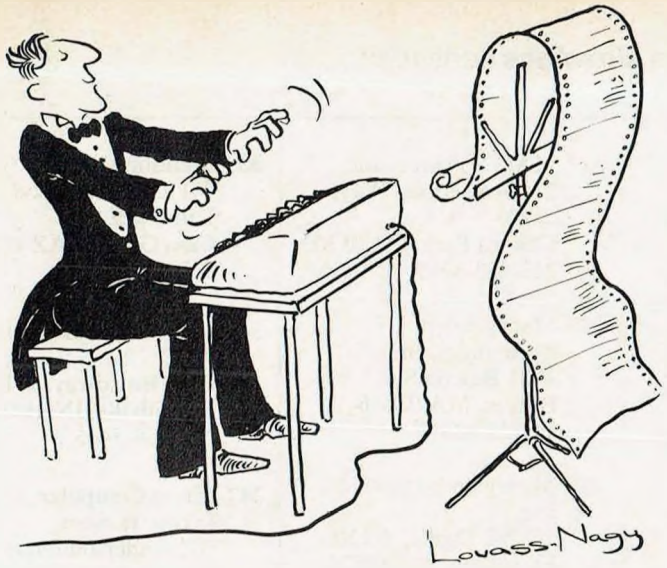

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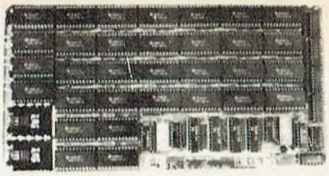

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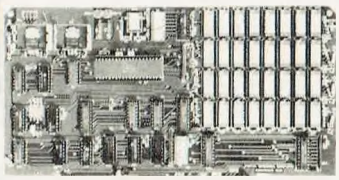

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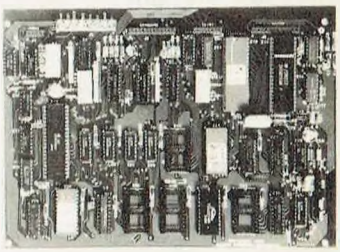

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CIRCLE 6 ON READER SERVICE CARD

A DEBUG Subroutine

A technique for making program debugging easier

by Lawrence A. Azlin III

Debugging stands out as the most tedious part of programming. The day will come, hopefully soon, when all compilers and languages for small computers will include an interactive debugger that allows you to work at the source level. Until then, most of us are left with either tracing through the assembly code generated by our Pascal or C program, or embedding print statements at various trouble-prone spots in the code.

While recently struggling with just this problem on a full-screen editor which I'm writing, it occured to me that the use of print statements could at least be made more uniform by embedding them in a single subroutine. Additionally, all it takes is a small table to allow selection of which messages will be printed on any given run. These techniques, while not entirely new, have proved so helpful to me that I'd like to pass them along.

A subroutine which I called "debug" handles the main part of this technique. It's called with two parameters: a string defining which part of the program is calling it, and a message string to be printed. Typically I use the first parameter to indicate which subroutine the program is executing when "debug" is called. Then, as a piece of code is being written, token messages are embedded at the entry and exit points, and anywhere else that might be troublesome. However, "debug" doesn't unconditionally print out all messages it gets. Instead, it looks the first string up in a table, and only if it is found does the message print. A value is also returned by "debug" to assist in more complex actions: TRUE if the first string is found in the table, FALSE otherwise.

This gives me a function that I can routinely call, but which produces output only for those parts of the code with which I'm concerned.

One of the greatest advantages of this method comes from being able to dynamically specify the table. Upon loading, a program first calls "debugsetup", which issues some instructions and accepts user inputs as entries in the table. If you don't want any messages, don't put any entries in the table. Or, just specify that one subroutine which you think is causing all the grief. Run the program again, and debug it in a different way. Refine your knowledge of the problem and debug another section. All this can be done without intermediate compilations!

A number of enhancements are possible, such as one or more numeric fields as additional parameters, limits on the number of messages from a given subroutine, or pattern matching on entries in the table. It would even seem to be a easy matter to incorporate calls to "debug" as a compiler option, allowing the tracing of execution paths if not full interactive debugging.

The following code compiles under BDS C, although any C compiler should handle it. Conversion to Pascal would be trivial. A 150-byte array called "debarray" holds the table, with each string being pointed to by an entry in "debnames". Both must be global and static.

Lawrence A. Azlin III, 537 Jones #8304, San Francisco, CA 94102

```
/*****************************************************************
                        DEBUGSETUP
*****************************************************************/
debugsetup ()       /* Set up the array debnames from operator
                       input on each run. Up to 10 function
                       names may be entered for tracing.      */
{
    int     i, j;

    puts (" Enter up to 10 function names of up to 15 characters\n");
    puts (" each, of functions to be traced. Null input terminates.\n");
    for (i = 0; i < 10; debnames[i++] = 0);
    i = 0; j = 0;
    while (i < 10) {
        if ((debarray[j++] = getchar ()) == '\n') break;
        debnames[i++] = &debarray[j - 1];
        while ((debarray[j++] = getchar ()) != '\n');
        debarray[j - 1] = 0;
    }
}

/*****************************************************************
                            DEBUG
*****************************************************************/
debug (fname, text)     /* If fname is in the list of functions to
                           be traced, write the text to the printer
                           and return a TRUE value. Else return a
                           FALSE value and do nothing.            */
char    *fname;
char    *text;
{
    char    printline[80];
    int     i, found;

    found = FALSE;
    for (i = 0; (debnames[i] != 0) && (i < 10); i++) {  /* Name found in list */
        if (strcmp (fname, debnames[i]) == 0)
            found = TRUE;
    }
    if (found) {
        printline[0] = 0;
        strcat (printline, "From ");
        strcat (printline, fname);
        strcat (printline, ": ");
        strcat (printline, text);
        text = &printline[0];
        while (*text != 0) bdos (5, *text++);   /* BDOS function 5    */
        bdos (5, CR);                           /* writes a character */
        bdos (5, LF);                           /* to the printer.    */
    }
    return (found);
}
```

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The Ackerman Digital Systems' Synthetalker

by Dennis Thovson

Computer-generated speech, once a laboratory curiosity and only within the province of large mainframe computers, has undergone a revolution in recent years. The development of increasingly powerful microprocessors and the rapid reduction in the cost of semiconductor memory has made speech synthesis a practical computer communication tool. Texas Instrument's Speak & Spell, a low-cost speech synthesizer with a moderately large vocabulary, is a good example of how much progress has been made in this field. Another example is the Votrax SC-01 Speech Synthesizer, the device used by the Ackerman Digital Systems "Synthetalker." However, before we get into the details of the Synthetalker, let's take a brief look at speech synthesis techniques.

There are two different approaches to synthesizing speech as produced by the human voice: You can digitize the analog electrical representation of the speech waveform, or model the human vocal tract. Both of these approaches have many variations which have been developed in the past few years to optimize the trade-off between fidelity versus data rate.

The technique of digitizing a speech waveform was introduced into the telephone industry in the mid-sixties and is now widely used for voice transmission over the telephone network. The technique, commonly called pulse code modulation (PCM), is based on sampling the analog speech waveform and encoding the amplitude of the sample into a digital signal. Sampling theory tells us that if an analog signal is sampled at twice its highest frequency—the Nyquist rate—the amplitude of the samples contains enough information to reconstruct the original analog signal exactly. In practical applications, two considerations prevent us from achieving theoretical performance. First, the signal to be sampled must be band-limited so that no analog energy exists in the spectrum above one half the sampling frequency. Second, in digital systems the amplitude of the sample can be preserved only in discrete increments called the quantizing intervals. The telephone industry uses a sampling rate of 8 KHz and encodes the amplitude of the sample into an 8-bit word (256 discrete levels). The resulting data rate is 64 kilobits/second (Kb/s) for each voice signal. The quality of a voice signal transmitted in this way is very good and sounds natural. However, a 64 Kb/s data rate, even with today's inexpensive memory, is not generally practical for microcomputer-based speech synthesizers. Therefore, one must ask, is a 64 Kb/s data rate really necessary for synthesizing acceptable quality speech? The answer is no, but don't expect something for nothing.

Since the actual information rate of ordinary speech is quite low, complex algorithms have been developed to lower the data rate required for encoded speech. Delta Modulation and Adaptive Differential PCM (ADPCM) are two techniques that have been extensively researched during the past few years. ADPCM seems to be the leading contender today. Speech synthesized at a data rate of 16 Kb/s using ADPCM techniques yields voice quality very close to that previously achievable only at 64 Kb/s. At lower data rates, the quality starts to suffer, but intelligible speech can be generated at rates down to approximately 2 Kb/s. There is a lot of work going on in this area, so we can expect significant progress in the coming years. As an interesting sidelight to the digitizing approach, the newly introduced digital playback system developed by Phillips and Sony uses PCM techniques to synthesize a high-fidelity stereo signal from binary information stored on a small disk. To achieve the required fidelity and dynamic range, a laser is used to optically read PCM-encoded information from the disk at a data rate of approximately 1.6 Mb/s!

Simulating the vocal tract is of interest because it is possible to synthesize intelligible speech at quite low data rates. Two variations of this technique are commonly used today—linear-predictive coding and phoneme synthesis. Linear-predictive coding refers to programmable control of the gain, exitation frequencies, and the coefficients of a multistage filter. Acceptable synthesized speech quality can be achieved at a data rate as low as 1000 b/s. The Texas Instrument's Speak & Spell uses this technique.

Phoneme synthesis refers to the generation of the basic sound units which make up spoken words. A small set of these basic sound units, when properly chosen and correctly timed, can synthesize intelligible speech. The Votrax SC-01 Speech Synthesizer Chip used by the Ackerman Digital Synthetalker employs this method of speech synthesis. The data rate required for the Votrax SC-01 is about 70 b/s, which makes it a very practical product to use with the current generation of microprocessors.

Votrax SC-01 speech synthesizer

The SC-01 is an LSI circuit fabricated using CMOS technology and packaged in a 22-pin DIP. It is an essentially self-contained device that generates speech by combining, in the appropriate sequence, the 64 different phonemes it can produce. A unique 6-bit word is supplied to the SC-01 to produce each of the desired phonemes. Although the time duration of each phoneme is different, the average data rate required to produce continuous speech is about 70 bits per second. This translates to about 12 bytes per second for an 8-bit computer since all data is handled in 8-bit words, although the SC-01 only requires 6 bits of the word per phoneme. The SC-01 provides a status signal to indicate to the controller (computer) when it is ready for the next input word. The phonemes produced generate an audio signal suitable for driving an external amplifier (the Synthetalker has an onboard audio amplifier).

Each of the 64 phoneme codes generates a unique sound (including "no sound") with a predetermined duration.

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For instance, 00H produces the sound for "e" as in jacket with a duration of 59 ms, while 01H produces the sound for "e" as in enlist for 71 ms, and 02H produces the soune "e" as in heavy for 121 ms. Each phoneme code also has a symbol assigned which should, with a little practice, make it easier to phonetically compose a word from its component phonemes. In any case, there is a dictionary supplied with the Votrax which gives the symbol sequence for about 1500 words. The word "computer" for example, is synthesized by combining the phoneme symbols K,UH1,M,P, Y1,IU,U1,T,ER.

Synthetalker hardware

The Synthetalker is a well-laid-out, solder-masked epoxy glass board populated with quality components. It can be obtained either assembled and tested or as a kit (the board I reviewed was assembled). According to the manufacturer, it is an S-100 compatible board that can be used with IEEE-696 or prestandard CPUs. Options are provided to adapt the board to variations in pSYNC, pSTVAL, and ADDRESS timing. The board operated as received without any option changes in my IEEE-696 CompuPro Z80 system running at 6 MHz.

In addition to the Votrax SC-01, the Synthetalker also contains an 8-bit digital-to-analog converter (DAC) that can be used to control the pitch of the SC-01; alternatively, its output can be mixed with that of the SC-01. Almost limitless sound effects can be generated by the combination of the SC-01 and the DAC. The audio output of the board is furnished by an amplifier that can provide a 250 mW signal into an 8-ohm speaker. This is generally enough power to drive a small high-efficiency speaker to adequate sound levels. The audio output level can be changed programatically. Two parallel ports are provided: one for input and the other for output. Options are provided for strobing data into and out of these ports. The Synthetalker itself uses four contiguous I/O port addresses to communicate with the system CPU. An on-board DIP switch can set the base address of the board to any value that is divisible by four.

Using the Synthetalker

A variation on Murphy's law prevents any new addition to my computer from working without some modification either to the software or hardware. In this case it was the software furnished by Ackerman Digital that was assembled to work with a Synthetalker base port address of 0C0H. So when I typed "DEMO" and sat back and waited for the Synthetalker to speak to me, all I got was a lot of strange disk activity. Unfortunately, I had forgotten that the base port for my disk controller is also at 0C0H! So, after editing and reassembling the Demo program file and searching through the manual to find how to change the base address of the I/O ports, I tried again. Voilà! It not only talks, but also plays music! Time to call in the spouse for a demonstration of the marvels of modern technology. Well, you can't win them all. She definitely was not impressed. In fact, she could not understand most of the speech the first time through. I'll admit it does take a little getting used to, but once you become attuned to a very mechanical-sounding monotone voice, the Synthetalker does produce intelligible voice output.

The audio quality of the voice output, though low fidelity to start with, is affected by the speaker used. You either need a high-efficiency moderate-size 8-ohm speaker that the Synthetalker can drive directly, or an external amplifier to drive low-efficiency or larger speakers. A cheap 2" speaker will not produce acceptable fidelity.

The DAC on the Synthetalker is capable of producing a wide range of sounds, including music. The Demo program included a rendition of that all-time synthesizer favorite, Bach's "Jesu, Joy of Man's Desiring." The first time I heard it, the tempo sounded a little brisk. The source code for the DAC music driver is not commented at all, so it took a little experimentation to find the right value for what I determined to be a tempo assignment within the program. I assume this was necessary because of the 6 MHz clock in my system.

Phraser software

Along with the Synthetalker, Ackerman Digital sent me a copy of their Phraser software, which is available from them at extra cost. I found the software package quite useful and a great time saver for developing new words and sentences. Basically the Phraser software is an 8080 assembly language program written to help programmers develop application-dependent vocabulary. It is an interactive program with a dictionary and a number of commands to help develop new words. Sentences or phrases can be constructed from the words in the dictionary and tried out before they are added to your application program. New words can be generated, using the Votrax phoneme symbols, and added to the dictionary. When you are satisfied with the words or the phrase you have created, a command will write out an assembly language source file containing a Synthetalker driver subroutine and the code for the message to be sent. The source file is directly compatible with Microsoft's MACRO-80 assembler and can be linked into your application program. This command also has the capability to generate a Basic program containing DATA statements instead of assembly language if so desired.

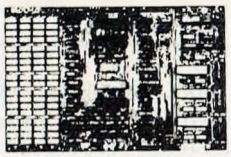
Documentation

Synthetalker's documentation is reminiscent of the manuals supplied with first-generation microcomputer kits circa 1976—written by the designer with heavy emphasis on how the board works and very little on how to use it. To be fair, I think all the information necessary to use the Synthetalker is in the manual—you just have to hunt a little to find it. It is probably fortunate that the manual is not too long!

Since the Synthetalker can be purchased as a kit, the manual has a section on board construction. Obviously written for the experienced bare board builder, this section

After editing and reassembling the Demo file program and searching through the manual, I tried again. Voilà! The Synthetalker not only talks, it plays music! Time to call in the spouse for a demonstration.

The Mega Super Computer



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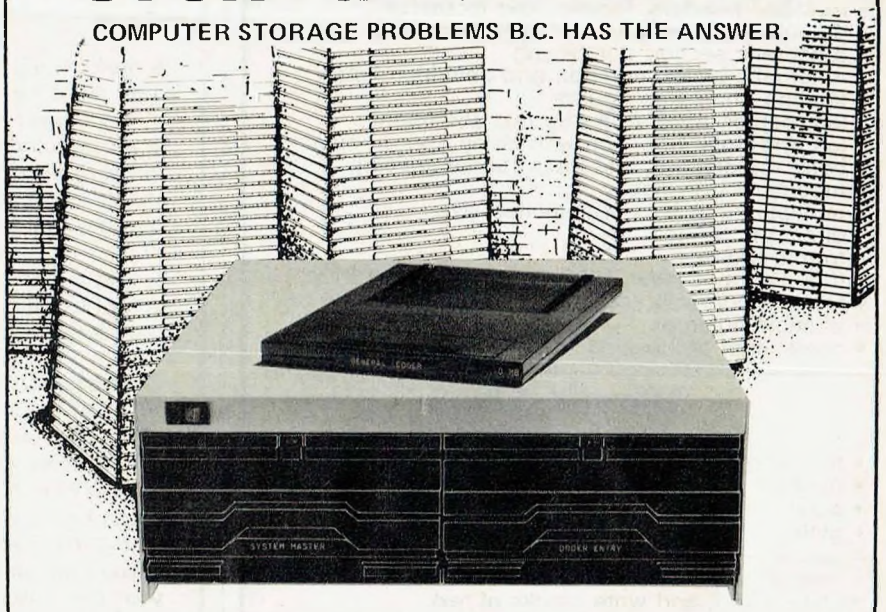

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CIRCLE 157 ON READER SERVICE CARD

Ackerman Synthetalker continued . . .

furnishes only general construction guidelines. Also, almost all of the board options are described in this section.

A demonstration program written in 8080 assembly language is included in the manual. It is liberally commented, so the competent assembly language programer should be able to use the program as an example for writing custom routines. Since Ackerman Digital furnished a copy of their Phraser software with the Synthetalker, I did not try the program in the manual. However, the demonstration program furnished on the disk, along with source code, was considerably more elaborate than the one in the manual.

Conclusion

All in all, the Synthetalker was a lot of fun to use. The audio quality, once you get used to it, is quite intelligible—for you amateur radio operators it is something like getting used to listening to mistuned single-side-band. Voice output is becoming such an important consideration today that synthesizers like the Synthetalker are in high demand. If you have an application that requires voice output and your computer has limited processor time or memory available, you would do well to consider the Synthetalker.

The Synthetalker is available from Ackerman Digital Systems, Inc., 110 North York Road, Elmhurst, Illinois 60126. A&T price $310. It is also sold as a kit, with all sockets and passive components soldered in. The user inserts the ICs and does his own jumpering and testing. The optional Phraser software is also available for $49.95.

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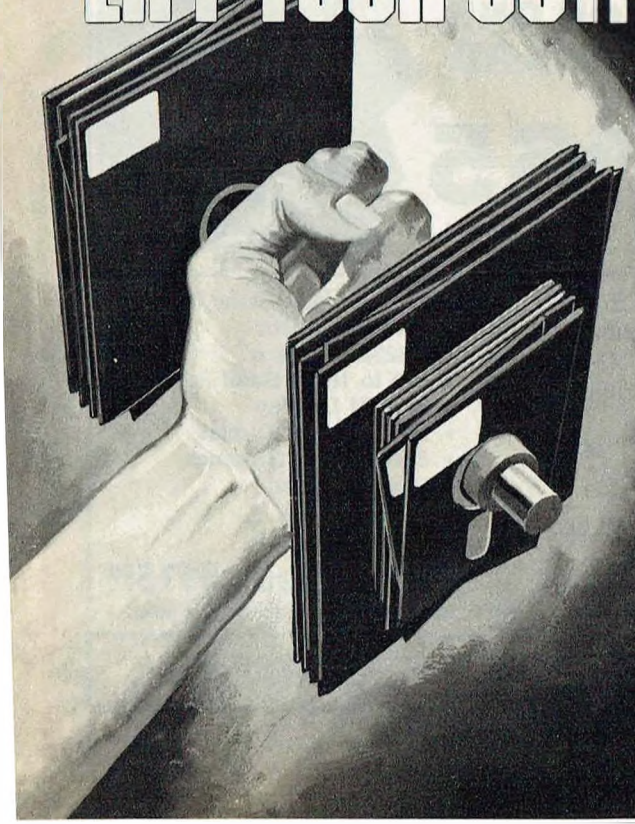

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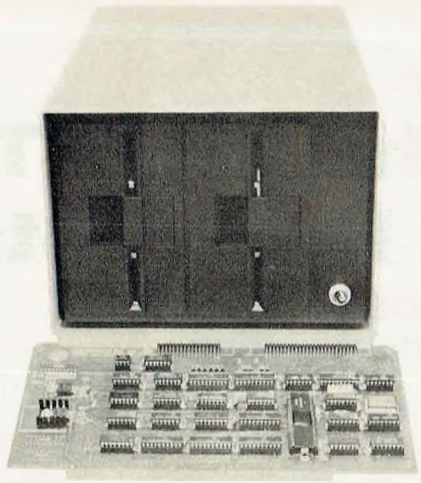

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CIRCLE 123 ON READER SERVICE CARD

Implementing the IOBYTE Function on the North Star

Patch the North Star CP/M BIOS so that it uses the IOBYTE for input/output routing

by Ted Carnevale

North Star's version of CP/M 2.2 has one shortcoming: it does not implement an IOBYTE feature. Instead, the CPMGEN utility (North Star's equivalent to MOVCPM) patches the jump table at the start of the BIOS so that the list output is sent to a parallel or serial port, depending on the user's preference at the time of installation. Because of this, the command

```
STAT <logical device>:=<physical device>
```

has no effect. This is no problem for most users, who will have a stable configuration of peripheral devices and may not need to redirect output using STAT. However, it becomes a major drawback if you have a "print spooling" program which depends on the IOBYTE to tell it where to send output.

The CACHE/Q disk buffering utility is one such program. In its latest version, CACHE/Q adds a spooling facility to its other functions. When CACHE/Q is installed with INSTALLQ, it defaults to a print-buffering mode. If the IOBYTE is not implemented, commands such as PIP LST:=<textfile> will just fill the buffer, and the printer won't budge. The same holds for TYPE <filename> with the CP/M printer toggle (^P). The text-printing functions of WordStar and other editing programs won't work either.

The only way to restore printer output is to invoke the CQ MODIFY command to disable CACHE/Q's printer buffering. This leaves any text which has already been buffered inaccessible, and eliminates one of the convenience features of CACHE/Q.

A practical answer to this problem is to patch the North Star CP/M BIOS so that it uses the IOBYTE for input/output routing. The accompanying partial BIOS provides this feature. This program is based partly on the USER.ASM source provided by North Star, and incorporates modified sections of Steve Bogolub's public domain MBIOS56. With this patch, CACHE/Q's print buffering works properly.

North Star's CP/M reserves 512 bytes for the "user BIOS area" (i.e., the portion of the BIOS which is not involved in disk I/O). My revised USERBIOS takes up only 340 bytes, even with RAM parity initialization, leaving ample room for expansion.

Ted Carnevale, M.D., Neurology Dept., SUNY, HSC T12, Rm. 020, Stony Brook, NY 11794

The introductory comments in the listing briefly outline the IOBYTE layout and function, and describe the ports which I decided to assign to the standard CP/M devices in my system. These device assignments are arbitrary, but fairly typical for an installation with a console attached to the left serial port and a parallel printer. Users with a serial printer can change the IOBYTE to 00xxxxxx in order to direct lst: output to the right serial port.

Because my system does not have 12 different peripheral devices, I put a block of equates at the beginning of the data-routing section to take care of the nonexistent devices. When I add a CompuPro SS1 board, I will include new code to drive its serial port and change the equates for bat:, ur2, up2: and ul1: accordingly.

The parallel output routine has been changed from the North Star version so that it can send 8-bit ASCII codes in order to take advantage of special features offered by printers such as the Epson MX-80. If your printer uses only 7-bit codes, you may prefer to keep the original parallel output routine supplied by North Star.

This program was written to be assembled and compiled by Microsoft's M80, but it can be changed for nonrelocating assemblers such as Digital Research's ASM. The .REL file generated by M80 must be loaded with L80 to produce a .COM file that will subsequently be patched into the SYSGEN image of CP/M.

Before installing the patch, you must generate the appropriate size CP/M with CPMGEN, being sure to answer "S" when asked whether the printer is hung on the serial or parallel port. Any other response will result in CPMGEN altering the BIOS jump table so that the patched system will not boot. After exiting CPMGEN, and with the CPMGEN image still in memory, invoke DDT as follows:

```
A>DDT
-IUSER.COM
-R3100
-G0
A>
```

Then use SYSGEN to write the altered system on the target disk.

Cold boot with this disk and check the IOBYTE with STAT's DEV: command; try reassigning the devices with STAT and see what happens to the DEV: assignment list. If you assign anything to the CON: logical device, it had better be present and capable of both input and output, or you will have to reboot to get control of your computer again!

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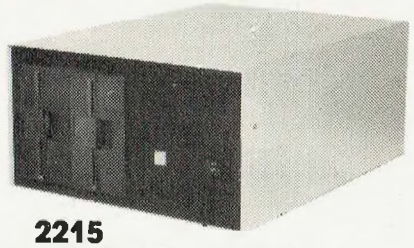

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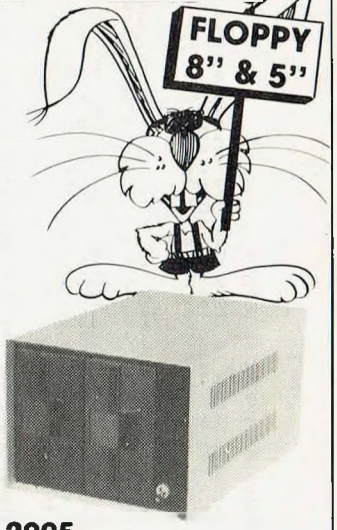

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```
                USERBIOS FOR NORTHSTAR HORIZON

Patched 3/2/83 for parallel output to EPSON MX80, and revised so printer
test (liststt) returns a non-zero value (printer always ready).
Revised 3/3/83 for IOBYTE implementation--which was lacking from the
NorthStar original.

Revised 8/24/83 so ttyin: and crtin: check the 8251s' status flag, and
altered cnsin: appropriately.  Also changed the number of stop bits to 1.

These routines are for standard Horizon systems.  May be replaced
in either the sysgen-ram-image at 3200h-33ffh, or in sector 8
(in the system track area), or in its actual executable location
(7a00h-7bffh in 32k system).


Performs character input/output for the CP/M peripheral devices
(con:, rdr:, pun:, and lst:), directing data flow according to
the IOBYTE setting.

IOBYTE layout--  XX XX XX XX
                  1  p  r  c
                  s  u  d  o
                  t  n  r  n



        LOGICAL  \      BITS IN IOBYTE
        DEVICE     \  00   |  01   |  10   |  11
        -----------|-------|-------|-------|-------
          con:     |  tty  |  crt  |  bat  |  ucl
          rdr:     |  tty  |  ptr  |  url  |  ur2
          pun:     |  tty  |  ptp  |  upl  |  up2
          lst:     |  tty  |  crt  |  lpt  |  ul1


Horizon device/port assignments:
tty     r serial
crt     l serial
bat       "     *
ucl     r serial
ptr     r parallel (input)
url     l serial input
ur2       "     *
ptp     l parallel (output)
upl     r serial output
up2       "     *
lpt     l parallel
ul1     l serial output *

        *--SSl serial port in future revisions


Initial IOBYTE-- 10 00 00 01 for con->crt
                                rdr->tty
                                pun->tty
                                lst->lpt

        @

;
true    equ     0ffffh
false   equ     not true
;
hram    equ     true            ;if using NS HRAM board with parity check
ram     equ     0c0h            ;standard i/o port address of HRAM board
paron   equ     41h             ;enables parity check
paroff  equ     40h             ;disables it
;
;
;  console definitions
;
mothr   equ     000h            ;horizon motherboard base
lser    equ     mothr+2         ;horizon left serial base
rser    equ     mothr+4         ;horizon right serial base
;
;  iobyte definitions
;
iob     equ     10000001b       ;what it is
iobyte  equ     3               ;where it goes
;
        .8080
aseg
memsize equ     64              ;size of available memory in kilobytes
userb   equ     (memsize*400h)-600h     ;for floppy drive version of BIOS
        org     100h
;       org     3200h   ;for sysgen image
        .phase  userb
;
;
;****** beginning of "user area" jump vector *****************
;
table:  jmp     init    ;cold boot init (usart & parity setup)
        jmp     cnsck   ;console test for input
        jmp     cnsin   ;console input
        jmp     cnsot   ;console output
prtser: jmp     list
        jmp     punch
        jmp     reader
        jmp     listst  ;test printer status - always ready
;
;****** end of user area jump vector *************************
;
;
;******* initialization is performed only on cold boot *******
;
init:   mvi     a,iob           ;init the iobyte
        sta     iobyte          ; for con:=crt: and lst:=lpt:
        xra     a               ;init horizon motherboard
        out     mothr+6
        call    idelay          ;delay for 8251's
        mvi     a,0aeh          ;init serial ports
        out     lser+1          ;output dummy mode to insure
        out     rser+1
        call    idelay
        mvi     a,040h          ; cmd expected, then output
        out     lser+1          ; reset cmd
        out     rser+1
        call    idelay
        mvi     a,4eh           ;mode: 1 stop bit, 16x clk,
        out     lser+1          ; 8 data bits, no parity
        out     rser+1
        call    idelay
        mvi     a,037h          ;cmd: rts, er, rxen, dtr, txen
        out     lser+1
        out     rser+1
        call    idelay
        in      lser            ;flush receiver inputs
        in      rser
;
;init parallel ports
        mvi     a,30h   ;reset par. input flag
        out     mothr+6
        mvi     a,60h   ;set par. output  flag
        out     mothr+6
;
;
        if hram
;
;set up parity check feature on NS HRAM board
        mvi     a,paroff        ;turn off parity check
        out     ram
;now step through memory, starting at 0000 and ending at 0ffffh,
;checking for the presence of ram at each kbyte boundary.
;if ram is found, set up the parity bits
        lxi     h,0     ;start at 0000
;test first byte of eack 1k block
kbck:   mov     a,m     ;get first byte of kbyte
        cma             ;complement it
        mov     m,a     ;  and put it back
        cmp     m       ;if ram is present, a-m=0
        cma             ;restore previous value at location (hl)
;NorthStar warns that this section of code may self-destruct if it
;crosses a 1k boundary--check the .prn file to ensure this doesn't happen.
        mov     m,a
```

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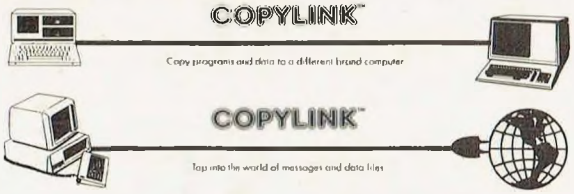

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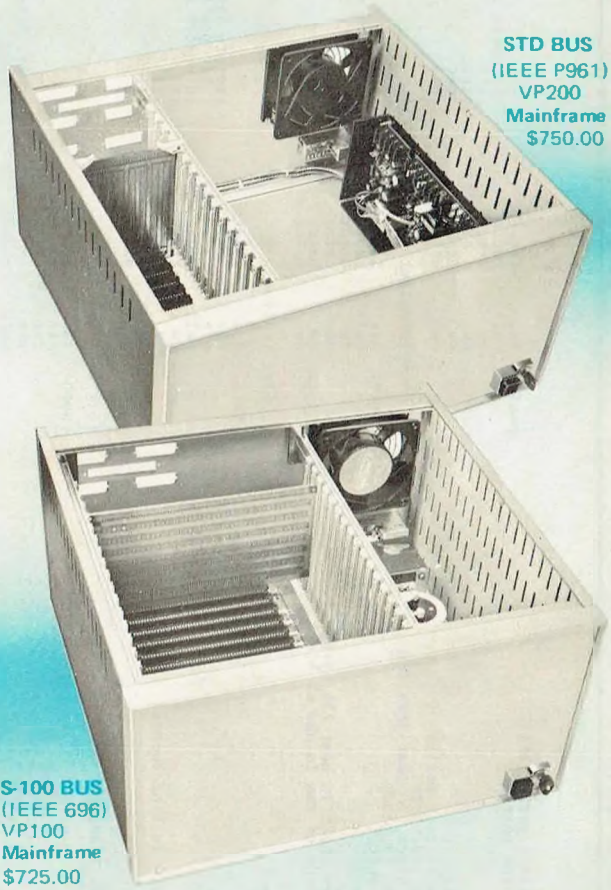

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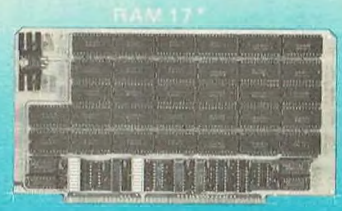

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```
        jz      pinit   ;ram present->initialize parity bit
        inr     h       ;ram not present->check next k
        inr     h
        inr     h
        jmp     nextblk
pinit:  mov     b,m     ;get contents of (hl)
        mov     m,b     ;  and put back with correct parity
        inr     l       ;increment low order addr byte
        jnz     pinit   ;if not end of 256b block, do next location
nextblk:inr     h       ;move to next 1k block
        jz      pfin    ;h->0 when done, so quit
        mov     a,h     ;if not on 1k boundary,
        ani     3
        jnz     pinit   ;  then set up parity check in next 256 bytes
        jmp     kbck    ;else test for presence of ram in new kb block
;
;parity bits set, enable parity testing
pfin:   mvi     a,paron ;activate parity check
        out     ram
;
        endif
;
;finally send "cr" to the printer & exit
        mvi     c,0dh   ;a carriage return
        jmp     userb-700h+15 ;goto "jmp list" in bios vector
;
;
;this delay subroutine helps with timing when resetting
;the 8251 USART
;
idelay: lxi     b,600h
idel5:  dcx     b
        mov     a,b
        ora     c
        jnz     idel5
        ret
;
;******* end of initialization code *********
;
;
;******** now the data-routing section ********
;
batchk  equ     crtchk          ;will be sslchk
batin   equ     crtin
batot   equ     crtot
;
uclchk  equ     ttychk
uclin   equ     ttyin
uclot   equ     ttyot
;
urlin   equ     ttyin           ;will be sslin
ur2in   equ     ttyin           ;  "
;
ptpot   equ     lptot
uplot   equ     ttyot
up2ot   equ     ttyot           ;will be sslot
;
ullot   equ     crtot           ;will be sslot
;
;  console status
;
cnsck:  call    cons            ;get hardware status
        rz                      ;if no char ready, return 0
        mvi     a,0ffh          ; else return 0ffh
        ret
;
cons:   lda     iobyte          ;get iobyte
        call    route           ;dispatch to status routine
        dw      ttychk          ;tty:
        dw      crtchk          ;crt:
        dw      batchk          ;bat:
        dw      uclchk          ;ucl:
;
;  console input
;
cnsin:  call    conin           ;get char
        ani     07fh            ;strip parity
        ret                     ; and return in acc
;
conin:  lda     iobyte
        call    route           ;dispatch to input routine
        dw      ttyin           ;tty:
        dw      crtin           ;crt:
        dw      batin           ;bat:
        dw      uciin           ;uci:
;
;  console output
;
cnsot:  lda     iobyte
        call    route           ;dispatch to output routine
        dw      ttyot           ;tty:
        dw      crtot           ;crt:
        dw      batot           ;bat:
        dw      uclot           ;ucl:
;
;  list (output)
;
list:   lda     iobyte
        rlc                     ;rotate lst: bits to low
        rlc                     ; bit positions
        call    route           ;dispatch to list routine
        dw      ttyot           ;tty:
        dw      crtot           ;crt:
        dw      lptot           ;lpt:
        dw      ullot           ;ull:
;
;  punch (output)
;
punch:  lda     iobyte
        rrc
        rrc
        rrc                     ;shift bits
        call    routel
        dw      ttyot           ;"output" assumed in all but tty
        dw      ptpot
        dw      uplot
        dw      up2ot
;
;  reader (input)
;
reader: lda     iobyte
        rrc                     ;shift bits
        call    routel
        dw      ttyin           ;"input" assumed in all but tty
        dw      ptrin
        dw      urlin
        dw      ur2in
;
;  the routing routine
;
route:  rlc                     ;double for word offset
routel: ani     06h             ;strip unused bits
        xthl                    ;get dispatch table addr
        add     l               ;add offset to get
        mov     l,a             ; to correct vector
        inc     route5
        inr     h
route5: mov     a,m             ;pull vector
        inx     h
        mov     h,m
        mov     l,a
        xthl                    ;stack vector, restore hl
        ret                     ; then off to routine
;
;******** end of iobyte decoding/data routing section ********
;
;  list status
;
liststs: xra    a               ;say it's ready
        dcr     a
        ret
;
;
;******* the specific device handlers follow *******
;
;  tty: routines set up for right serial port
;
ttychk: in      rser+1          ;get port status
```

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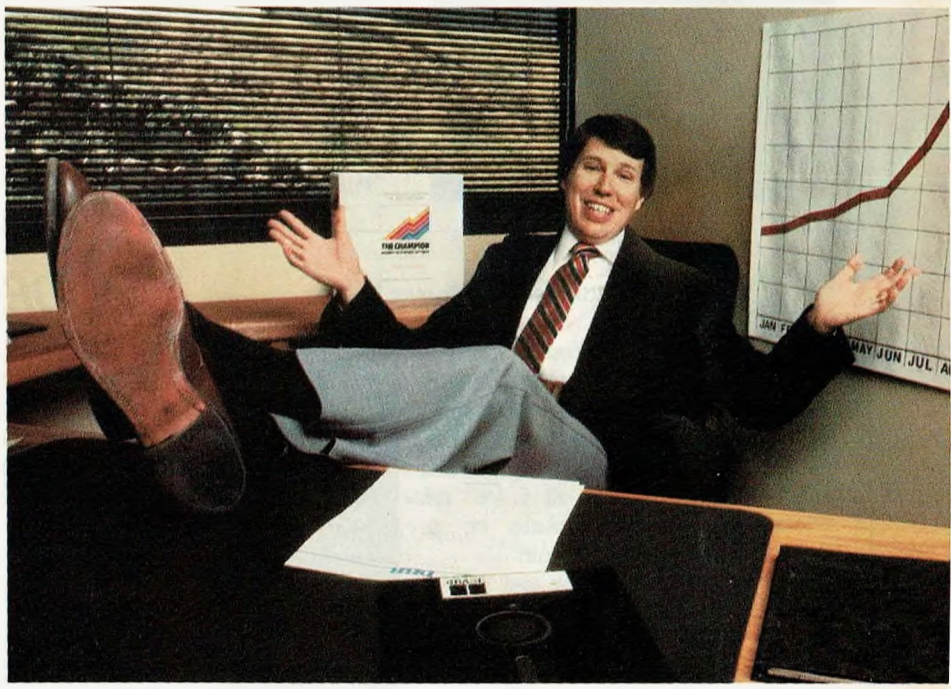

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North Star IOBYTE Function continued . . .

```
                ani     2               ;check receiver
                ret                     ;ret non-zero if ready
                ;
ttyin:          call    ttychk
                jz      ttyin
                in      rser            ;get port data
                ret
                ;
ttyot:          in      rser+1          ;get port status
                rrc                     ;xmit buffer empty?
                jnc     ttyot           ;if not, wait til is
                mov     a,c             ; then output char from c
                out     rser
                ret
                ;
;;  crt: routines, same as tty:, but use left serial port
                ;
crtchk:         in      lser+1          ;get port status
                ani     2               ;check receiver
                ret                     ;ret non-zero if ready
                ;
crtin:          call    crtchk
                jz      crtin
                in      lser            ;get port data
                ret
                ;
crtot:          in      lser+1          ;get port status
                rrc                     ;xmit buffer empty?
                jnc     crtot           ;if not, wait til is
                mov     a,c             ; then output char from c
                out     lser
                ret
                ;
;;  ptr routine uses right parallel (input) port
                ;
ptrin:          in      mothr+6 ;motherboard status
                ani     2       ;pi flag
                jz      ptrin   ;loop until data
                in      0       ;read data from parallel port
                push    psw     ;save byte
                mvi     a,30h   ;reset value
                out     mothr+6 ;reset pi flag
                pop     psw     ;restore input byte
                ani     7fh     ;clear parity bit
                ret
                ;
;;  lpt routine uses left parallel (output) port
                ;
lptot:          in      mothr+6 ;motherboard status
                ani     1       ;test po flag
                jz      lptot   ;external device not ready yet
                ;
;this is the parallel port output section which uses the mx80 correctly
                ;
                mov     a,c     ;get character to be sent
                out     0       ;send it
                mvi     a,20h   ;reset the flag
                out     mothr+6
                mov     a,c     ;and restore the character to a
                ret             ;finished
                ;
;******** this is the end of the bios patch *********
                ;
                end
```


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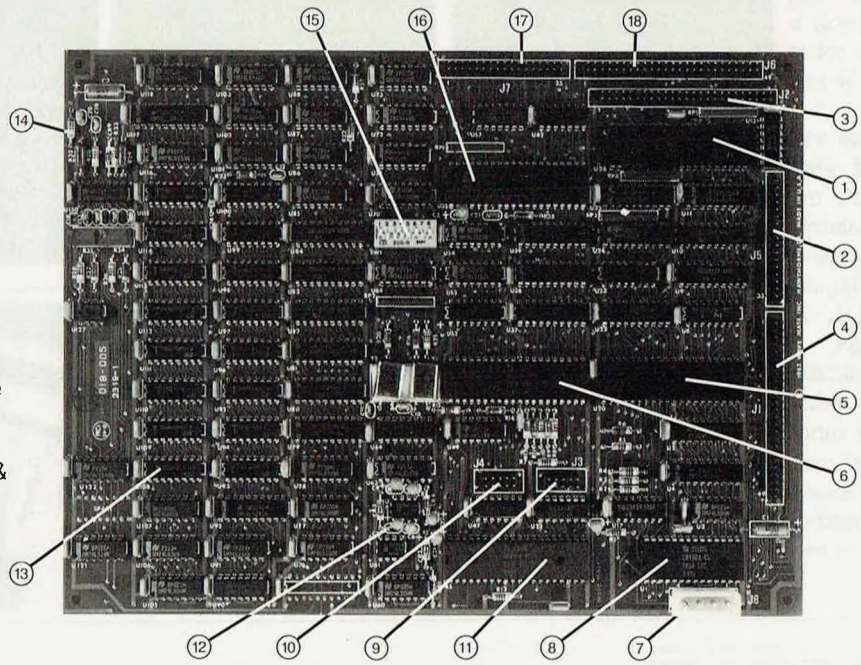

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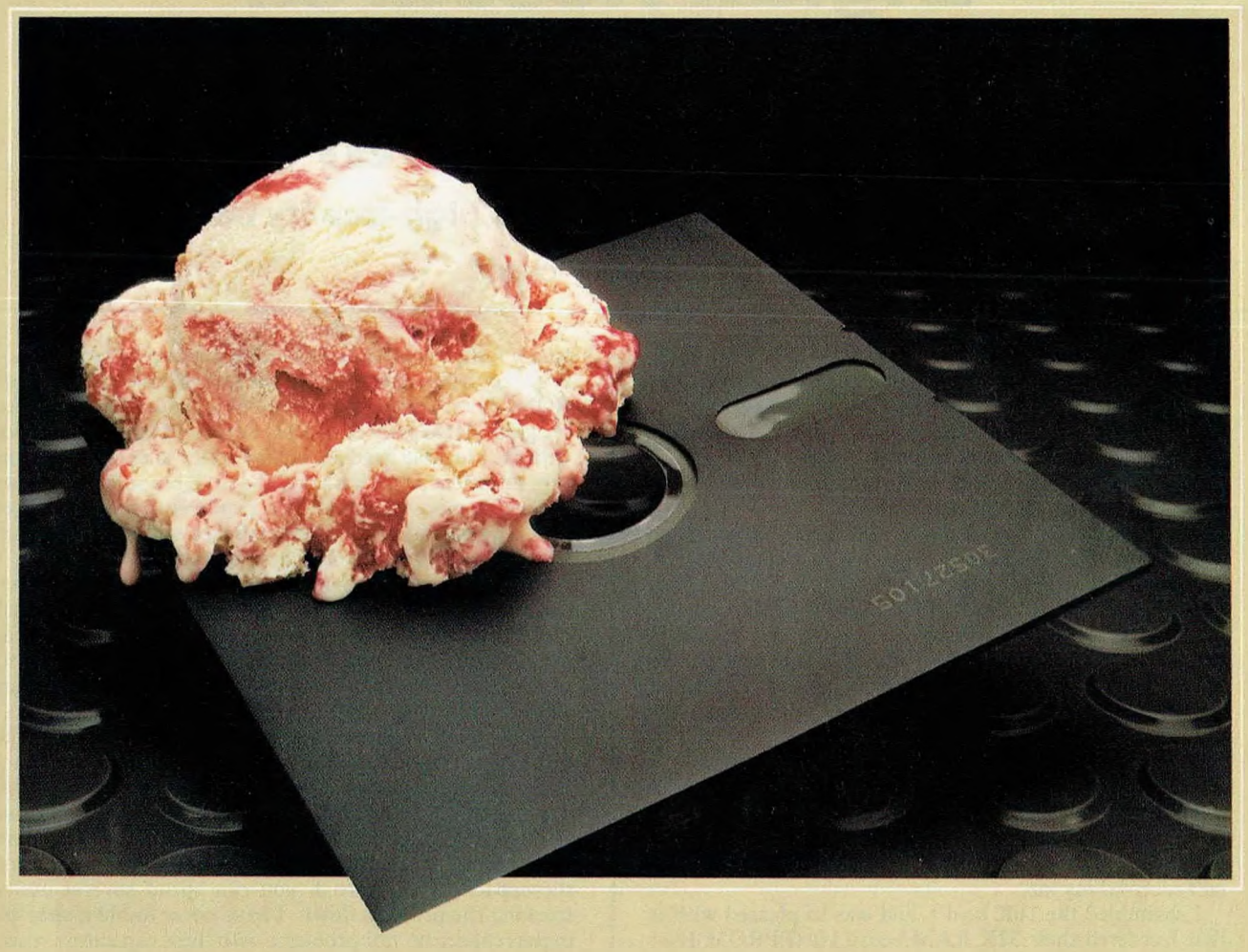

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Digital Research Computers' 16K and 32K Static RAM Boards

Expand system memory with two high-quality boards

by Mark D. Pickerill

Starting computer life with a 4K Level I TRS-80, then moving up to a full-blown system has proved to be a very educational experience. Still, as an electronics technician, I wanted a computer that had greater hardware flexibility and could run under CP/M. In late fall of 1981, therefore, I purchased a brand-new IMSAI.

Though on a limited budget, I managed to scrounge 16K worth of 2102 memory chips free, as well as two 8K bare boards to stuff them on. This gave me an S-100 system with 16K of RAM and no I/O. Since I was eventually planning to get a disk system for the IMSAI, I knew I needed more memory. Enter the 16K and 32K RAM boards from Digital Research Computers (not associated with Digital Research Incorporated, the creator of CP/M).

When I researched the 16K RAM board market, I found that this board (which apparently has no model number) was by far the cheapest. From the ads, it sounded very good at $149.95 (it has since been reduced to $119.95). I rushed off an order, and in about a week and a half received my kit.

I assembled the 16K board, and was so pleased with it that I ordered their 32K RAM board kit (EPROM II at $139.95) to complete my memory. This one arrived in about three weeks. A call to the factory revealed (logically enough) that their shipping schedule depended on the number of orders received: the more they have to ship, the longer it takes.

Documentation

The contents of both documentation packages are very good. Though not quite Heathkit concise, the documentation is written in a style that may best be described as "condensed Heathkit," and is printed in a good, readable dot-matrix print. However, while the manual for the 16K board was easily readable, documentation for the 32K was one of those slick, grey, hard-to-read copies. Another criticism is that the schematics in both packages are drawn freehand. Although the schematics are readable, it would be nice if D.R.C. would spend a couple of hours drafting them.

Assembly

The 16K board went together without a hitch, while the 32K board had a minor assembly problem. The assembly instructions stepped me right through the construction phases to completion. Solderability was very good on both the boards and the components, with one exception. The 32K board is actually a multifunction board (more on this later). Jumper blocks and plugable headers at each memory socket determine whether the socket contains RAM or ROM. These jumper blocks are tin plated. I would rather see gold-plated jumper blocks, not only for better contact with the plugable headers, but for better solderability. I am very experienced with a soldering iron, but soldering these jumper blocks was a challenge. However, I was able to get a good connection with a little patience, and had no further trouble assembling the 32K board.

I did do one thing that differed from what the instructions called for in assembling the 16K board. The manual says to install a 16-pin socket and use jumpers for bank select. I am not very fond of plugable jumpers (as opposed to soldered jumpers or plugable headers), so I installed an eight position DIP switch in this location.

Here's a tip. Whenever assembling any computer equipment, *always* test all the bypass capacitors with an ohmmeter (preferably analog). The capacitors should "kick" the needle, then the needle will return to a higher value. Tantalum capacitors should also be checked, but at the lowest range of your ohmmeter. The value is this: If one of the capacitors is shorted, you can spend several hours tracking the problem down. I have never found a shorted bypass capacitor, nor problems with these capacitors when assembled, but have seen others spend days tracking down this problem.

Quality

Since I work in the microcomputer field, I know well-designed hardware when I see it. These boards are of the highest quality material. Every chip, both memory and support, is bypassed on the 16K board. The bypassing on the 32K board is not quite as extensive but still very good, especially since the 32K board uses very low-power memories. All voltage regulators on both boards are bypassed on both input and output by 6.8 microfarad tantalum capacitors. Good-quality sockets are used for the address select jumpers on the 16K board. These pins do not hold the jumpers as tightly as I would like to see, although in operation they seem adequate. Both boards appear to be very well designed.

Board features and set-up

There are significant differences between the 16K and the 32K RAM boards, so I'll describe them separately.

The 16K board uses 2114 x 4 static RAMS, with four voltage regulators. All options are selected by jumpers (unless you install a switch for bank select, as above). The board is addressed as four 4K blocks, with each block addressed separately by installing a single jumper. Wait states 0-4 can be selected with another jumper. The board can respond to phantom by installation of a jumper between two pads, and you have the option of reset enable or

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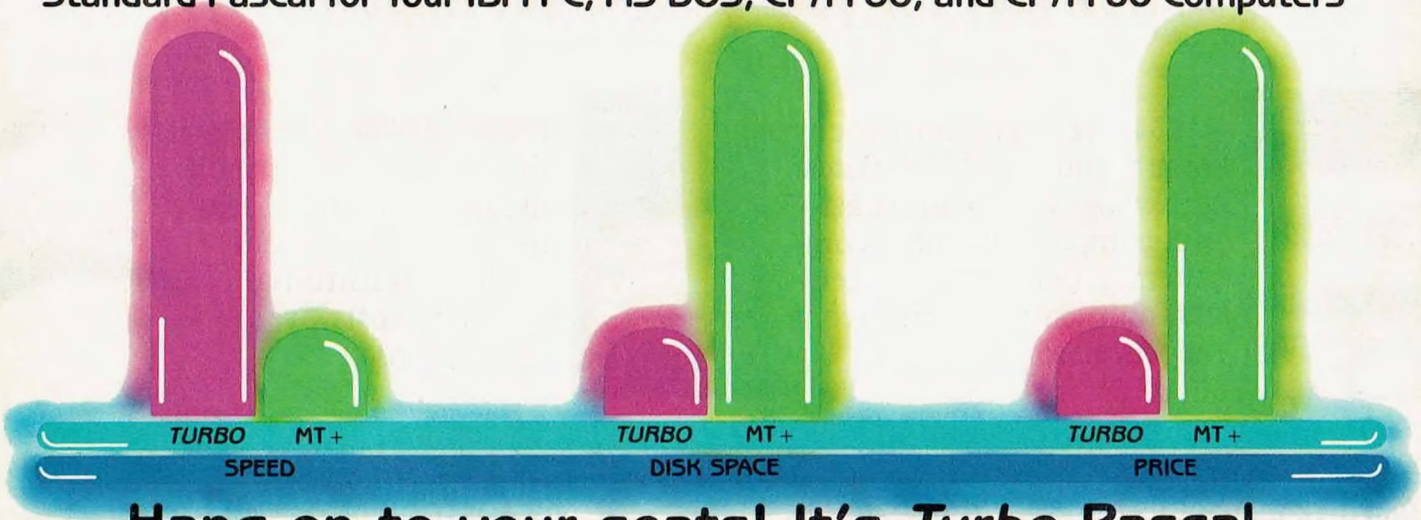

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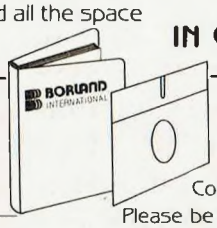

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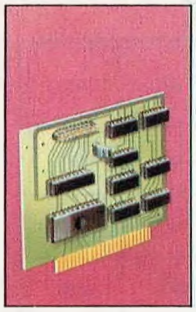

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reset disable with still another jumper. Finally, the board supports "Cromemco Standard" bank select (port 40H).

The 32K board uses the new 2016 2K-wide RAMS (2K x 8). These chips use so little power that only two voltage regulators are needed to operate the entire board. This is a good example of how far memory technology has progressed in the last few years. My 8K boards with the old 2102 memory chips felt like a blast furnace after five minutes' operation. The 16K board (below) with 2114 devices is only slightly warm after hours of use. The 32K board (top right) is literally cold after being on all day!

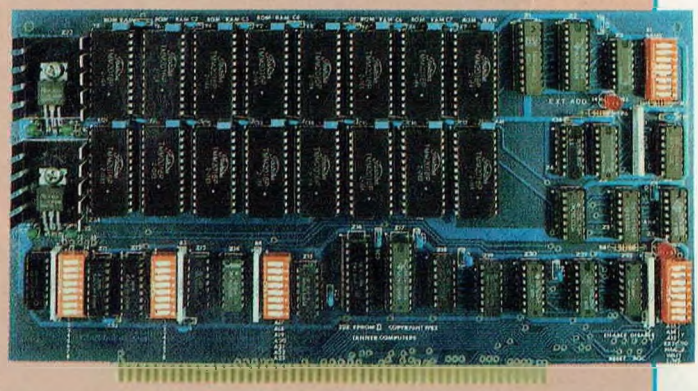
The 32K board is actually four boards in one. According to the manual, this board can be used in any one of four ways:

1. As a 32K 2716 EPROM board
2. As a 32K 2732 EPROM board
3. As a mixed 32K 2716 EPROM/2K x 8 RAM board
4. As a 32K static RAM board.

Of course, I am using the board as a 32K RAM board. Under normal operation, all options except RAM/ROM are selected by the five (WOW!) DIP switches. The first two switches are segment disable switches. These switches enable you to disable any of the 16 memory devices to allow for memory-mapped I/O, PROM memory on another board, etc.

I found an interesting characteristic of this board while testing the segment disable. If you disable a memory chip, the chip still responds to a memory write. This, of course, does not matter because the data cannot be read.

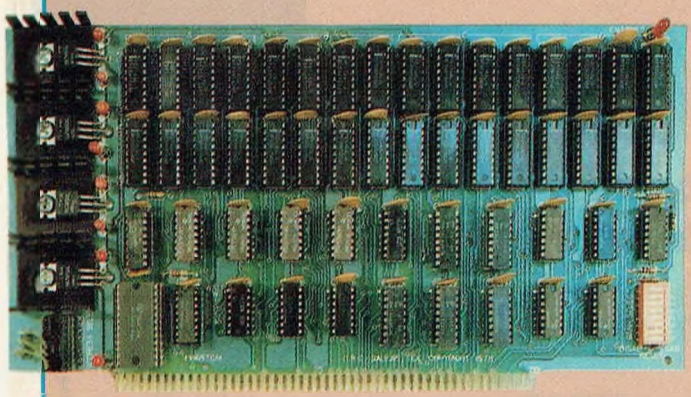
A third switch is for extended address operation (A16-A23), while a fourth is addressed as two 16K blocks, two pairs of A14-A15 switches are used; one pair for each block. Other sections of this switch enable or disable extended addressing, phantom disable, zero or one wait state, and Cromemco (port 4OH) or North Star (port 20H) bank select. Lastly, the fifth switch determines which bank the board is part of. Both boards have an LED indicator that comes on when the board is bank enabled. In addition, the 32K board also has an LED that lights when the board is extended-address enabled.



As mentioned above, the 32K board can also use 2716 EPROMs. This is selected by installing the plugable header in the appropriate position, next to the socket(s) that you wish to contain EPROM.

Two seldom-used options require cutting "cuttable traces" and installing jumpers: 1) reset disable, and 2) using the board as a 32K 2732 EPROM board.

A potential problem exists when you are using these boards in a system that does not employ bank select. The problem: No bank-select disable. You cannot tell the boards to ignore the bank select port. If you write out to the bank-select port by accident, then, depending upon how the bank-select switch is configured, the boards can disappear from the address space. There are three possibilities. First, the bank-select switch has some, but not all, switches turned "on." Depending upon the data, the board could "disappear" upon an output to the bank port. Second, all bank-select switches are on. You are fairly safe here. If your system doesn't employ a bank select, I'd recommend setting all bank switches on. This way, only a zero to the bank port will disable the board. Third, and last, all switches are off. This is the worst. Any output to the bank port will disable the board. Admittedly, these three possible problems are remote: software doesn't usually write to random port addresses, but I feel that a potential user should be aware of these possibilities. My system does use bank select, so this is not a problem. I'll add that my Cromemco PROM board cannot have these problems because it has a bank-select disable option.



PHOTOS BY JILL SCHMIDT

Compatibility

The 16K board is not an IEEE-696 compatible board because it does not support extended addressing. Other than that, I cannot find any other incompatibility. Since there are many systems not using extended addressing, many users will not consider this a drawback. This board has evidently been around for a while, since the silk screen on the board is dated 1978. The 32K board reads "32K EPROM II Copyright 1982 Tanner Computers." Tanner Computers? Evidently, D.R.C. has purchased the 32K board from another manufacturer. This idea is further supported by the fact that the 32K board is blue, while the 16K board is

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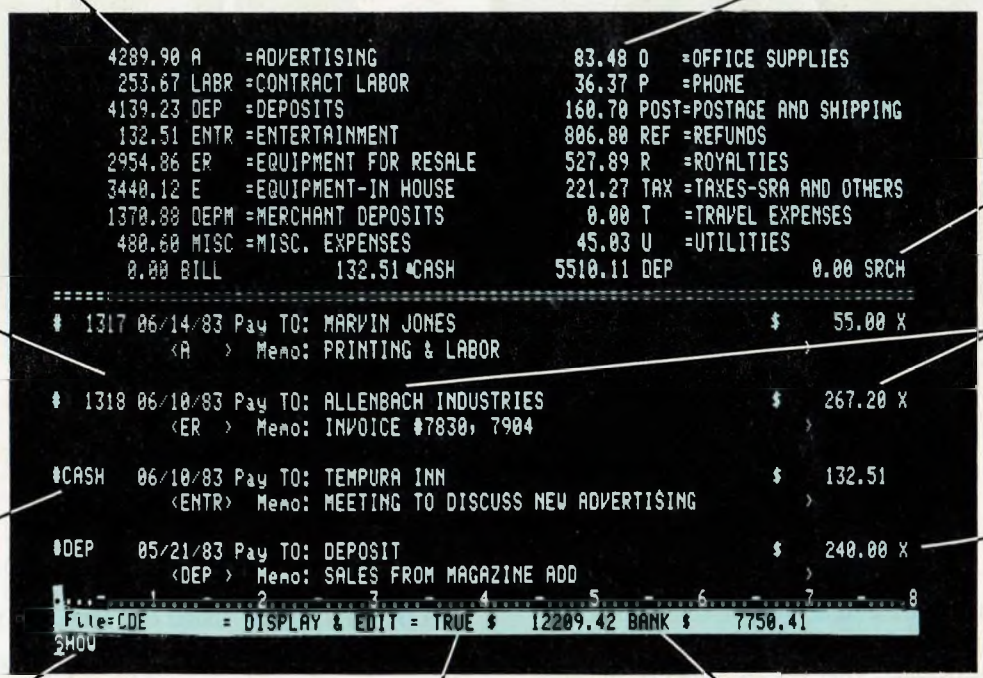
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green. The 16K board has D.R.C. stamped right on it. Both boards are of equal quality.

Reliability

Since I won't be getting my disk system for at least another two months, my only way of testing the boards has been from the IMSAI's front panel, or running a test program I have in PROM. In the time that I have had them, both boards have passed the memory test program every time I've run it, as well as performing perfectly with the "goof-around" programs I have flipped in from the front panel. In view of the quality of these boards, I see no reason why they wouldn't be as reliable as any other well-designed memory boards.

Summary

The Digital Research Computers 16K and 32K RAM boards are extremely inexpensive, high quality, and versatile memory boards. Documentation content is good, although in the case of the 32K board, it is somewhat hard to read. Current price for the 16K board: $119.95 in kit form, (add $10 for 4MHz) or $33 for the bare board with documentation. Current price for the 32K board is $139.95 for 32K RAM kit, $80 for EPROM kit, or $39.95 for the bare board with documentation. The boards are available from Digital Research Computers, P.O. Box 401565, Garland, TX 75040. I am very pleased with both boards, and feel they are good buys for anyone who needs to expand memory with quality boards.

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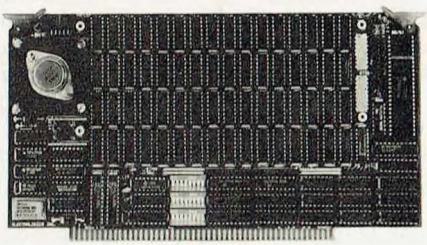

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Floppy Problems I Have Known

by Kenneth M. Piggott

There is a time for most computer enthusiasts when the urge to upgrade to a floppy-disk-based storage system becomes overwhelming. When the urge struck, I could no longer resist. As I had an S-100 system, the natural choice for an operating system was CP/M. I wish I could say that my choice of hardware components was an unqualified success. Unfortunately, it was not. Unlike most articles, this one will discuss some of the pitfalls I encountered.

As I have been building up my system for a long time, some of the components in my system are ancient, as microprocessor system boards go. My system, prior to updating, consisted of:

- Ithaca Intersystems Z80 CPU
- Godbout 16K memory
- Morrow WonderBus motherboard
- Home brew: A/D converter, cassette interface, PROM burner, realtime clock, printer interfacer card

The total memory available in my system at that time was 20K. While 20K is technically the minimum amount of memory that will work with CP/M 2.2, I don't advise it, as most CP/M programs require much more than that.

The first decision I had to make was whether I should purchase and integrate the various components, or whether I should purchase one of the single-board S-100 computers which incorporate the CPU, memory, and disk controller. Since I eventually hope to upgrade to a multiuser system, I was looking for a DMA-type controller. The limited research I had done on S-100 single-board computers indicated that I could not access the on-board memory from an external source (i.e., DMA transfer). Also, I'm a fan of static memory, and most of the single-board computers use dynamic memory. For better, or, as it turned out, for worse, I decided to go the separate component route.

For a considerable period of time, I've been interested in DMA (Direct Memory Access) floppy disk controllers. Specifically, the two boards that interested me were the Godbout DMA 1 and the Morrow Designs DJDMA. Fortunately, I had an opportunity to visit the NCC (National Computer Conference) in Houston. Godbout was absent from the show, but Morrow Designs was present and I was able to talk to George Morrow. Prior to my conversation with him, I had some serious doubts as to the possibility of adapting my Ithaca Intersystems CPU to the DMA controller. George Morrow indicated that the main compatability problems were with dynamic memory, which I did not have, and as long as the CPU board supported the DMA handshaking signals, there probably wouldn't be any problems. After confirming that my CPU card would support DMA transfers, I decided on purchasing the following:

- Morrow Designs DJDMA floppy disk controller (Photo 1)
- Fulcrum Computer Products 64K static memory board (Photo 2)
- 2 Mitsubishi 8" double-sided floppy disk drives (Photo 3)
- Dual 8" floppy power supply (U.S. Micro)
- Dual 8" disk enclosure (Jade)
- Dual 8" disk connecting cable

I decided to assemble the disk components myself because of economic reasons. The disk enclosure from Jade and the power supply from U.S. Micro totalled only $110. Add the price of the drives, cables, and controller, and the total cost is considerably under the price of the complete system from Morrow. The trade-off, of course, is that I would be responsible for integrating the components into a usable system. I must admit that, as an educational experience, my selection of components has been an excellent choice. Other than that, I recall the four months of problems I had and wonder about the wisdom of my choices.

The good news is that the 64K static RAM memory board from Fulcrum Computer Products (Photo 2) has worked flawlessly. The only caution I extend is to read the documentation very carefully. One misplaced jumper can prevent the board from working properly.

My problems occurred with integrating the disk system components. The documentation that comes with the Morrow DMA controller is woefully inadequate for the first-time CP/M disk system user. Some of the written documentation is contradictory to the documentation files supplied on the disks. When coupled with the Digital Research documentation on CP/M, the situation is one step removed from hopelessness.

After reading the documentation, I decided it was time to attempt to bring up the system. The DJDMA controller has an on-board serial port to which a terminal can be hooked. The initial configuration of CP/M communicates through that port. An adapter is required from the connector on the DJDMA to the DB-25 connector on the terminal. The first attempt at bringing up the system was doomed to failure. Hardware problems with the CPU card prevented proper DMA transfers. The problem lies with the MWRITE signal. As per the IEEE-696 standard, the DMA controller does not support the MWRITE line. If you have older S-100 boards that use MWRITE, your board will have to be modified. The inset shows all the changes which I made to the Ithaca Intersystems board. Once I corrected the CPU hardware problems, the system booted up. The difficulty now became one of configuring CP/M to my peripherals. If I had been familiar enough with using MOVCPM and SYSGEN, and had an assembled listing, I could have patched in my I/O routines. However, since the CP/M system supplied is preconfigured with drivers for a hard disk, which I don't have, and as these drivers take up room in memory, I decided to delete these and reconfigure my CBIOS. The Morrow CBIOS.ASM file is 130K long and is very intimidating to the novice. There are no clearcut instructions for modifying the CBIOS for the system. It's somewhat a trial and error proposition. Once you've made the changes to the CBIOS, you might think that all you have to do is assemble

Kenneth M. Piggott, 16166 Chesterfield, East Detroit, MI 48021

the CBIOS with the ÀSM program supplied with the CP/M package. Well, it doesn't work that way. The reason is you have to purchase the $90 Digital Research MAC assembler. When you try it, however, some of the internal symbols contain an illegal character. A little work with the ED program fixes that and, I'm happy to say, I finally was able to get an object file of a patched CBIOS. Incidently, the best source of integration instructions is in the file NOTESHD.TXT. Why it's in a file labelled "Notes Hard Disk" I'll never know. A happy ending? Hardly! If you remember, I remarked that because I purchased separate components, the responsibility for integration was mine. My problems were just starting.

It didn't take me very long to discover that I had compatability problems between the Mitsubishi disk drives and the Morrow DJDMA controller board. I could not reliably write on tracks 60 and above. Additionally, I wasn't able to get the drives working correctly in the double-sided mode. Repeated calls to Morrow Designs were not very successful. First of all, the phone lines to Customer Service are very difficult to reach. Often I would make eight to ten tries over several days. When I did get through, I received the impression that my problems were somewhat beyond them. Don't get me wrong. They were extremely courteous on the phone. Unfortunately, they weren't much help, either. One of my major difficulties with them was in trying to get a copy of the source listing of the on-board PROM. The company policy is not to distribute it. Through a lot of work (mostly guesswork) on my part, I discovered one of my problems to be that the Mitsubishi disk drives don't require any write precompensation. Write precompensation, however, is required on Morrow's standard drive, the Shugart (write precompensation shifts the timing of the write data stream with respect to the index signal on the inner tracks of the diskette). There are several disk controller chips on the market (the NEC 765 is an example) that have adjustable write precompensation to accommodate the Japanese drives. On the Morrow board, I used a simple hardware modification to disable the write precompensation. I removed IC 4B, bent out pin 6, and reinserted the chip in its socket. I then connected pin 6 on the foil side of the printed circuit board to ground with a jumper wire. This corrected my problem with writing on tracks 60 and above by eliminating the write precompensation. I still had the problem of getting the controller to work with double-sided disks.

Up to this point I had made six to eight phone calls to Morrow's Customer Service, as previously mentioned. Their assistance, while being cordial, had been minimal. One might suggest that the problem has been with the drives and not the controller. However, there are many controllers that work with the Mitsubishi disk drives. It is my personal feeling that buying and connecting disk drives is like buying a new set of tires for a car. You have to balance and align the tires, but they still work. I feel it should be the same with disk drives. There should be a procedure or software patch to adapt the disk drives to the controller. I also feel that since I purchased the myriad of components that I did, the responsibility for adapting the components should be mine. I would gladly make the necessary changes to the on-board firmware; however, Morrow regards the contents of the firmware's source listing as a closely quarded secret. Without the listing, there's no way I can integrate the components.

I decided to make one final call to Morrow Designs and ended up talking to George Morrow. He was exceptionally easy to talk with and seemed genuinely concerned with my difficulties with his product. He admitted that Customer Service has been swamped, that there was a lack of initialization documentation, and that the DJDMA board is probably not a product for the novice. While he wouldn't send me the source code, he did promise to send me a new PROM (this will be the fourth). Maybe this will fix my problems. Time will tell.

One other problem I mentioned while on the phone to California was that the heat sinks get very hot. In fact, I replaced the ones that came with the board with much larger ones. The explanation for the hot heat sinks was the relatively high current drawn by the custom bipolar ROMs. Because of the scarcity of the parts and their high current requirement, Morrow Designs plans to replace these parts with their CMOS equivalents. Consequently, the board should run much cooler in the future.

If I had to do it all over again, I doubt that I would do it the same way. It's been a tremendously educational experience, but one which I hardly consider worth the effort. For a novice disk drive and CP/M user like myself, a good alternative may have been one of the all-in-one computer boards. If an individual insists on going the route I have, I suggest that they check with the manufacturers of the components to confirm their compatability. Also, check with individuals and with CP/M application groups in

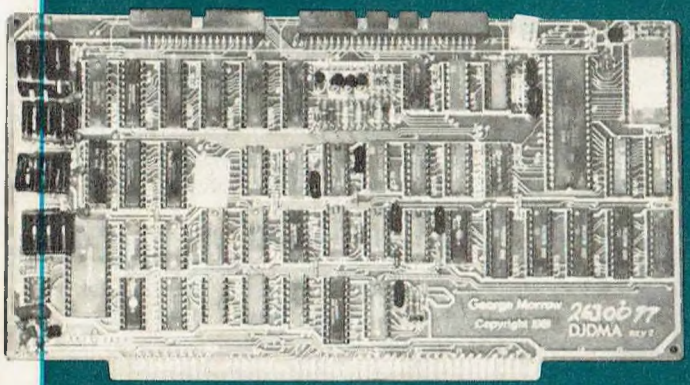

Photo 1. *The Morrow Designs DJDMA disk controller board. Note the large heat sinks on the left which I installed on the board in order to keep the power regulator temperatures down to a reasonable level.*

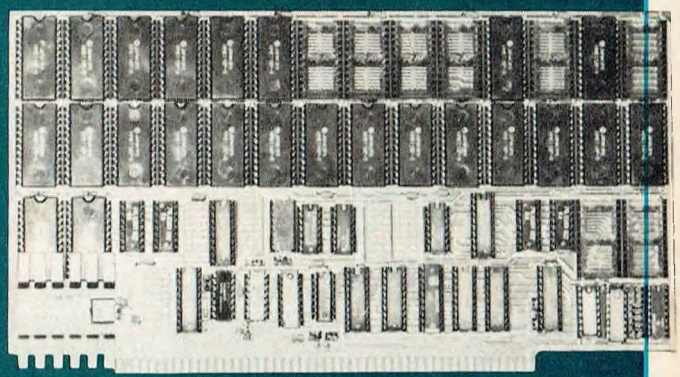

Photo 2. *The Fulcrum Computer Products 64K static memory board with 48K of memory installed.*

Board Modifications

These are some of the changes made to my Ithaca Intersystems board. The most important is No. 1. Nos. 2 and 3 may not be necessary for the operation of the DJDMA disk controller board, but they correct some timing problems. If you've never done this type of modification, don't do it. Get help from a friend.

#1. The wiring on my Ithaca Intersystems board was not as shown on the schematic. The MWRT signal floated high during the DMA operation. As I had some older boards which used MWRT (an active high signal), they were activated when this happened. The simple correction is to cut the trace between IC4 pin 13 and S-100 pin 68. Then ground pin 68. If your system should need a coincident MWRT signal with PWR*, then a different approach must be taken. For this, perform the modifications shown in the table at right.

#2. To correct the generation of SWO*, cut the connection between IC 19 pin 13 and IC 18 pin 2. Do this carefully as this trace is connected to other pins which should remain connected. Then connect IC 18 pin 2 to IC 19 pin 10.

#3. When this board was originally designed, the state-of-the-art 8080 chip at that time used a status latch chip. Accordingly, one was designed into the CPU board. Since the Z80 latches its status line, the on-board latch can be disabled by connecting pins 4 and 13 to ground after cutting the traces to those pins. The same caution as in No. 2 applies. This trace is connected to two other chips that should remain connected.

#4. Although I haven't implemented it yet, and the DJDMA doesn't require it, a correction for the pSYNC signal appeared in the October 1980 issue of *Micro-Computing*. You might try making this modification if you are having problems with other boards in your system.

1) Cut trace from . . .	2) To . . .	3) Reconnect to . . .
IC 4 pin 13	S100-68	—
IC 10 pin 11	S100-21	S100-45
IC 10 pin 12	S100-71	S100-77
IC 10 pin 13	IC 10 pin 2	S100-68
IC 10 pin 2	—	Ground

your area for advice on products they've used. Above all, think of any problems you may have as a terrific educational experience.

Editor's Note

We publish this article as a classic object lesson in the problems that can arise when an individual, however technically competent, tries to use a complex interface board with a peripheral not specifically supported by the interface manufacturer, and particularly one that is not in general use in the microcomputer industry. This is the case with the Mitsubishi drive. Morrow Designs evaluated two or three Japanese drives (though not the Mitsubishi) and found that they departed so far from the Shugart specifications (the de facto standard in the U.S.) that no attempt was made to support them. We summarize below some of the other issues raised by Ken Piggott, and George Morrow's responses.

PROM Source Code. *K.P.:* "As a customer, I believe I should have access to the information I require to adapt a product to my system. I am not asking for a solution to my problem, but rather the information to correct the problem myself." *G.M.:* "The code is extremely tricky; five months of hard work by a competent programmer were required to make the controller work reliably with Shugart and look-alike drives. To release the source code to an individual would expose us to a stream of further questions about it that we do not have the time to answer satisfactorily. I am not unsympathetic to the hacker, but to stay in business we have to allocate most of our time and efforts productively to our prime customers."

The drive. *K.P.:* "I feel that the Mitsubishi engineering data which I sent to George Morrow was sufficient to correct the problem as it exists with the DJDMA controller." *G.M.:* "There is no substitute for the hardware, as we found even with Shugart drives. If Ken's request to Mitsubishi to supply us with an evaluation drive on loan had been honored, we might have tried to get it working. We did not feel obligated to buy this drive, since we had received no other requests to support it."

A final note. Understandably, Ken Piggott is not happy with this situation—but then, neither is George Morrow. Many of our readers have found George helpful and sympathetic in solving problems relating to his products. But, he points out, S-100 products are no longer dominant in the market (you have only to look at Altos, Ithaca Intersystems, IBM, and all the portables to see how true this is). He will fully support his S-100 products in the environment for which they were intended, but if you want to match them to components not tested by Morrow Designs, there is a limit to the amount of help you can expect.

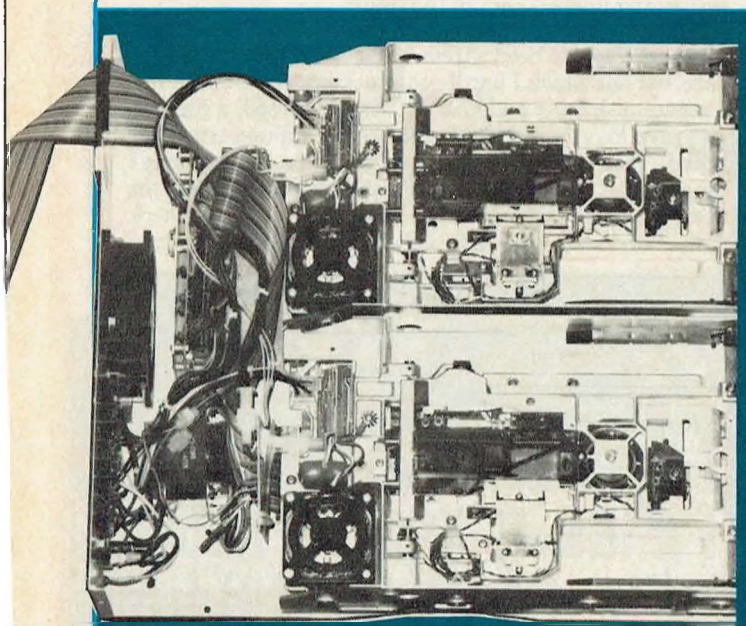

Photo 3. *Top view of my disk drive controller. To fit the power supply in, I disassembled the transformer from the power supply and remounted it in a more advantageous location. Note the Optronics Technology AC disk motor controller mounted at the rear of Drive A (drive at bottom of photo). It turns off the disk drive's AC motor when the drive is not selected, cutting down the wear and tear on the disk.*

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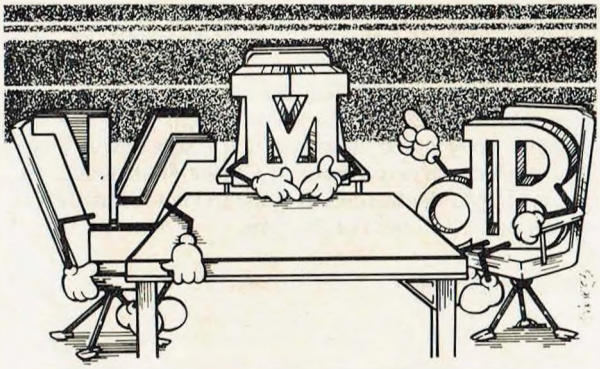

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Improved Trigonometric Functions for CBasic-80

by Robert Lurie

CBasic-80 has long been a popular language for commercial programming. It has never enjoyed much favor for engineering or scientific applications, however. The main reason for this, I suspect, lies in its use of BCD arithmetic, which executes more slowly than the binary arithmetic employed by Microsoft's Basic-80, for example. Nevertheless, CBasic's support of multiline user-definable functions and its use of labeled subroutines (labeled with numeric strings, but strings just the same) makes it one of the easier Basic languages to write long programs in. Furthermore, its use of 14-digit precision real numbers makes it at least as valuable for many technical applications as it is for business programs.

Recently, while starting to write an optical design program in CBasic, I discovered that there exist some serious weaknesses in CBasic's implementation of trigonometric functions. The sine and tangent functions truncate abruptly to seven digits of precision as their arguments approach zero. The cosine function behaves similarly as its argument approaches $\pi/2$. For most arguments, the arctangent function is accurate to only seven or eight decimal places, and since the computation of arcsines and arccosines is dependent on the arctangent function, their accuracy will be no better. Finally, whatever algorithm CBasic uses for argument reduction is extremely inefficient. The calculation of TAN (10000), for example, though not very likely to be encountered in actual practice, takes so long to perform that the first time I ran it I hit the reset button, thinking that my CPU had somehow gotten hung up.

The run shown in Figure 1 illustrates the kind of problems that the user of CBasic-80's trigonometric functions will experience.

Fortunately, CBasic's support of multiline defined functions makes it fairly easy to bypass these deficiencies. The program that follows is written in CBasic and is intended to be incorporated as an "include" file in any CBasic program that calls for the calculation of trigonometric or inverse trigonometric functions. To use it, simply insert the statement %INCLUDE TRIGFUN near the start of the program, and use the functions FN.SIN, FN.COS, FN.TAN, and FN.ATN rather than CBasic's built-in SIN, COS, TAN, and ATN functions. TRIGFUN.BAS also includes the inverse sine and inverse cosine functions FN.ASIN and FN.ACOS. Where no argument reduction is required, TRIGFUN.BAS is accurate to 12+ decimal places. As might be expected, it runs somewhat more slowly than the native functions, except where large argument reductions are involved. In such cases it runs a whole lot faster.

The coding of TRIGFUN.BAS reflects a personal convention I have adopted that calls for the use of such hard-to-read identifiers as "0", "00", and "0%" for variables, and "0.x" for constants that are 'local' to a multiline function, but nevertheless global to CBasic itself. I attempt in this way to reduce the chances that a function invocation will corrupt a main program variable, since I am not likely to use such unbecoming names in the body of a program itself.

The algorithms used in TRIGFUN.BAS were taken from the book *Computer Approximations* by J.F. Hart et al. (Krieger Publishing Company, Huntington, NY; 1978). I recommend this text highly to anyone interested in developing routines for computing transcendental functions. As a second source of information, I recommend the book *Software Manual for the Elementary Functions* by Cody and White (Prentice-Hall, Englewood Cliffs, NJ; 1980). This text is deliberately written in a cookbook style for systems programmers. Although it is much less comprehensive in scope than the Hart text, most readers will find it easier going. It is especially useful as a source of information on the testing of algorithms.

I have written to Digital Research about the trig function problems in CBasic-80 and inquired of them whether the functions are implemented in the same way in CBasic-86, CB-80, or the forthcoming CB-86. As I write this, nearly a month has gone by and I have yet to hear from them. My advice to the reader who has any of these languages is to test the transcendental functions carefully first.

Addendum

This paper was originally accepted for publication by *Microsystems* in October of 1982. In May of this year I learned from Digital Research that CB-80, CB-86, and CBasic-86 all suffer from the same trigometric function problems as CBasic-80. Digital Research indicated that they would soon release corrected versions of these three languages. They stated, however, that it was unlikely that they would issue a new version of CBasic-80. It would appear that Digital Research has come to view CBasic-80 as the computer equivalent of Sanskrit.

```
A>TYPE TANTEST.BAS

10
PRINT
INPUT R
PRINT ATN(TAN(R))
GOTO 10
END

A>CRUN2 TANTEST

CRUN VER 2.08
COPYRIGHT 1981 COMPILER SYSTEMS INC.

? .87654321012345E-6
 8.765432E-07

? .444444444444
 0.444444452085

? ^C
A>
```

Figure 1. *Examples of problems in CBasic-80.*

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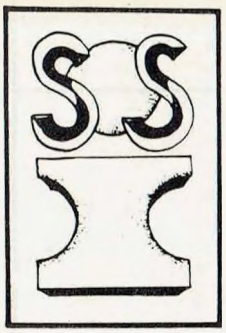

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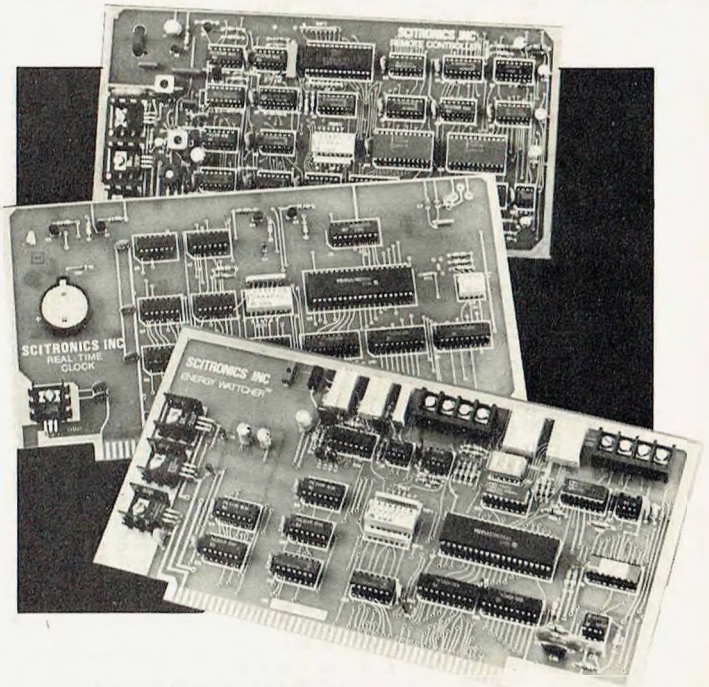

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CIRCLE 172 ON READER SERVICE CARD

```
\:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::\
\                                                                        \
\                TRIGFUN.BAS    %INCLUDE FILE                            \
\       Trigonometric functions for CBASIC-80 version 2.08               \
\             Copyright (c) 1982, Robert Lurie                           \
\                                                                        \
\:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::\

REM:::::::::::::::::::::::CONSTANTS:::::::::::::::::::::::::::::

O.PI = 3.14159265358979
O.SQR2 = 1.41421356237310

O.0 = +0.1038517145519977E4  rem Coefficients for TAN function
O.1 = -0.178056467143863E2   rem #4163; see J. F. Hart et al,
O.2 = +0.2624786459432ØØE-1 rem ch.6, COMPUTER APPROXIMATIONS,
O.3 = +0.264456219512224E4   rem Krieger Publishing Company,
O.4 = -0.18128328348540lE3   rem Huntington, NY (1978).

O.5 = +0.2160623078972431E3  rem Coefficients for ARCTN function
O.6 = +0.322662070013251E3   rem #5075; J. F. Hart, et al, ibid.
O.7 = +0.1327023981639776E3
O.8 = +0.128838303415732E2
O.9 = +0.216062307897243E3
O.10 = +0.394682839312283E3
O.11 = +0.2210508830284183E3
O.12 = +0.385014865083512E2

REM:::::::::::::::::::::FUNCTIONS:::::::::::::::::::::::::::::

DEF FN.TAN.HALF(X)
        O=ABS(X)/(O.PI+O.PI)
        O=8.0*(O-INT(O))
        O%=Ø
        WHILE O>1.Ø
                O=Ø.5*O
                O%=O%+1
        WEND
        OO=O*O
        O=O*((O.2*OO+O.1)*OO+O.Ø)/((OO+O.4)*OO+O.3)
        WHILE O%>Ø
                O=(O+O)/(1.Ø-O*O)
                O%=O%-1
        WEND
        FN.TAN.HALF=SGN(X)*O
        RETURN
FEND

DEF FN.SIN(X)
        X=FN.TAN.HALF(X)
        FN.SIN=(X+X)/(1.Ø+X*X)
        RETURN
FEND

DEF FN.COS(X)
        X=FN.TAN.HALF(X)
        X=X*X
        FN.COS=(1.Ø-X)/(1.Ø+X)
        RETURN
FEND

DEF FN.TAN(X)
        X=FN.TAN.HALF(X)
        FN.TAN=(X+X)/(1.Ø-X*X)
        RETURN
FEND

DEF FN.ATN(X)
        O=ABS(X)
        O%=Ø
        IF O>O.SQR2+1.Ø THEN O%=2: O=-1.Ø/O
        IF O>O.SQR2-1.Ø THEN O%=1: O=1.Ø-2.Ø/(1.Ø+O)
        OO=O*O
        O=O*(((O.8*OO+O.7)*OO+O.6)*OO+O.5)
        OO=(((OO+O.12)*OO+O.11)*OO+O.1Ø)*OO+O.9
        O=O/OO
        IF O%=1 THEN O=O+Ø.25*O.PI
        IF O%=2 THEN O=O+Ø.5*O.PI
        FN.ATN=O*SGN(X)
        RETURN
FEND

DEF FN.ASIN(X)
        O=ABS(X)
        IF O>1.Ø THEN PRINT "Illegal argument"
        IF O=1.Ø THEN FN.ASIN=SGN(X)*Ø.5*O.PI: RETURN
        FN.ASIN=FN.ATN(X/SQR(1.Ø-X*X))
        RETURN
FEND

DEF FN.ACOS(X)=Ø.5*O.PI-FN.ASIN(X)

REM:::::::::::::::::::::END OF TRIGFUN.BAS:::::::::::::

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```

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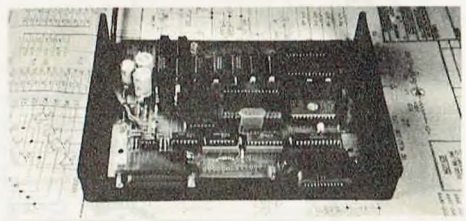

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CIRCLE 18 ON READER SERVICE CARD

Cheap Memory

64K of memory for $130

by Bill Kibler

Not too long ago I purchased a used IMSAI 8080 with 32K of memory. This amount of memory was not sufficient for me but, as is the case for many users, neither was my wallet. There are any number of 16K and 64K memory boards on the market for more than I can afford. The 16K boards start at $149 and the 64K units start around $400. Looking for a cheap fix, I discovered that the Altair 16K was being sold by Advanced Computer Products (P.O. Box 17329, Irvine, CA 92713) for $59.95. These untested boards proved to be convertible to 64K with only two extra 8T97s and five jumpers. Replacing the existing 4096s with 4116s completes the change for a total price of just over $130.

Hacking and cutting

The Altair 16K board is rather straightforward and can be modified quite easily. When purchasing the board, it is possible to get copies of the manual for a nominal charge.

Bill Kibler, Kibler Electronics, P.O. Box 487, Cedarville, 06104

The schematic is also available in the *S-100 Bus Handbook* by Dave Bursky. In fact, the manual I received had photocopies of the schematics from pages 184 through 187 of the *Handbook*. The drawings are labeled "Pertec/MITS 88-16MCD" and were originally issued in July 1977.

These vintage boards arrived in good shape and worked when first tested. There were several modifications already on the back of the boards, but more on that later. One problem that should be watched for involves the bus bars: they appear to make excellent levers for prying out chips with a small screwdriver, but beware! They can break off completely or just cause faulty operation of a single bank because of a broken lead. Use chips known to be good. If you have to replace chips, be sure to use a removal tool and a chip inserter tool (see Figure 1).

The changes involve the chip select line (pin 13 of the 4096s) and address line A6 (pin 13 of the 4116s). The original designers of the devices had this kind of compatibility in mind, making it possible to change memory size by simply changing what is on pin 13. For more information, see the *Mostek Memory Manual*; its reference section has several discussions on compatible memory arrays. The Altair

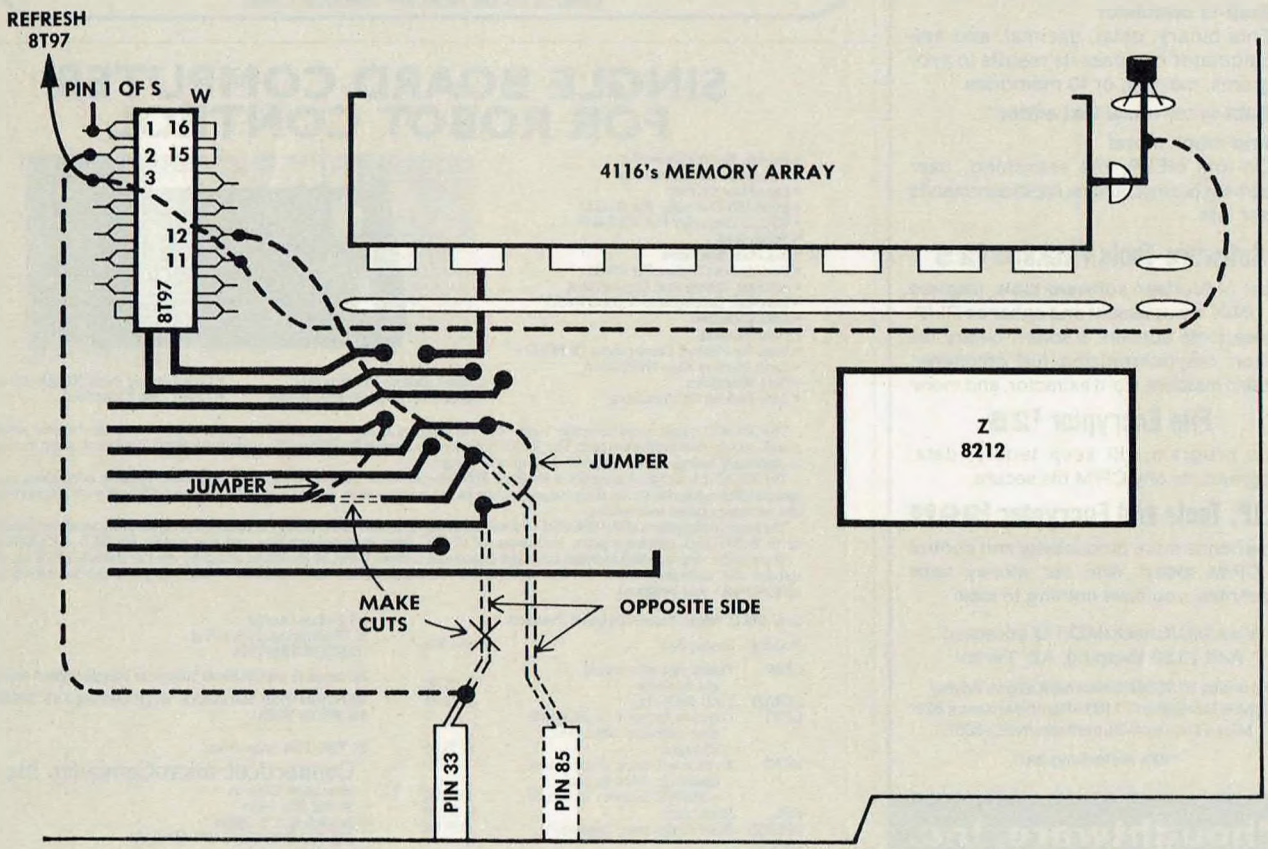

Figure 1. Address jumpers.

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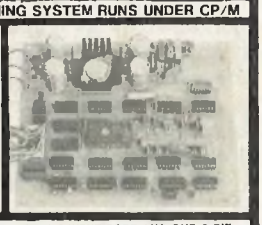

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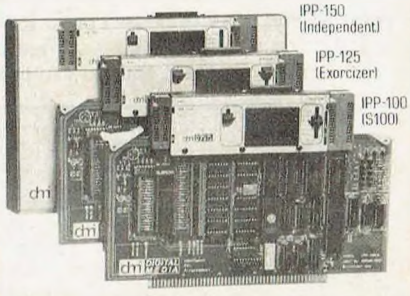

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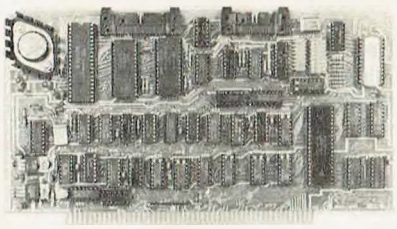

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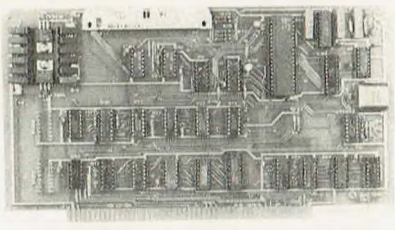

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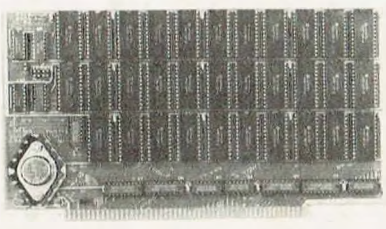

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address lines are buffered by 8T97s and gated onto the chip address inputs at the proper time.

The first step in the changeover is to install an 8T97 or 74367 (which we shall call W1) on top of chip W (8T97 buffer for A6 to A11) by bending out all pins except 8, 15, and 16, which get soldered to the same pins of chip W below.

Next, clean the foil on the top side next to the letter D, for memory row D (see Figure 2). Solder a wire to connect this point and pin 11 of the new 8T97. This is the chip select line, which needs to be cut on the back side at resistor pack 1, pin 5, the line that goes into the memory array. Pins 3 and 11 of the 8T97s are connected together, and a jumper is run from them to pin 1 of the other buffer chip S (which handles address lines A0 through A5).

A possible alternative to using two 8T97s is to use one 74125; this is a quad buffer with each buffer separately gated. Only three of the buffers are needed. However, since the 8T97 has 16 pins and the 74125 only 14, placement would be more difficult.

Address lines A12 and 13 are needed next; these are on pins 33 and 85 of the bus. The following cuts and jumpers can be best done by looking at Figure 2; the objective is to connect A12 to pin 2 and A13 to pin 12 of the new 8T97.

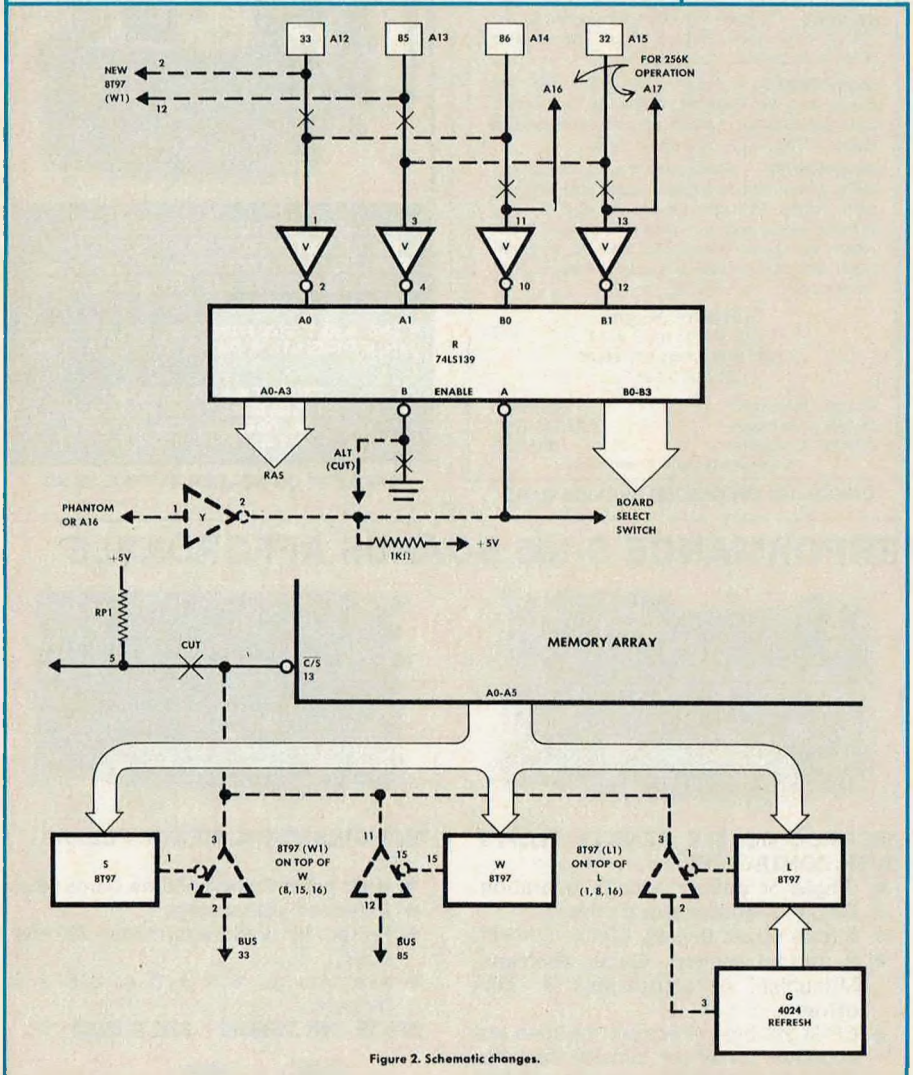

Figure 2. Schematic changes.

Jumpering A14 and A15 (instead of A12 and A13, now removed) to the old chip makes the board "select" switch active for bank select (so you can kill a 16K bank if it is not needed). Should 256K be desired, connect chip V, pins 11 and 13, to address lines 16 and 17 respectively; the bank select will then control which 64K bank is selected. The board is now ready except for one problem: refresh. The solution for this is as simple as the rest—use the 7th output of G (MC14024B), the refresh counter. Mount another 8T97 (L1), using only pins 1, 8 and 16, on top of chip L. Now connect pin 3 of G to pin 2 of L1 (the new 8T97). Connect pin 3 of L to pins 3 and 11 of W1 (the 8T97 piggybacked on W); this refreshes the new address line. Figure 3 shows the schematic changes.

Next, install the 4116s, and your board should then be ready to test as a full 64K of memory. This may sound confusing at first, but look at both the schematic and drawings before you start, because it is quite simple.

Phantom and Z80

You may have bought these boards some time ago and found that they did not work with your Z80 or had no phantom line. These solutions are as simple as the other changes with fewer jumpers. There are several ways to solve the phantom problem. My disk drive card could use either A16 or phantom on pin 67; I chose A16. A16 is on bus pin 16, and I jumpered it to the unused section of chip Y (74L04) pin 1. The inverted output on pin 2 was then used to disable the board address decoder chip by sending pin 1 of R (74LS139) high. This disabled the bank select option, but bank select could be used by selecting pin 15 instead, as would be necessary for 256K operation. Another phantom option is to disable the output buffer through pin 9 of chip U (74LS27). The choice is yours, and all these methods seem to work. To guarantee a high on the disable line, connect it through a 1K pullup resistor to +5V. A convenient place for this is from pin 16 (+5V) to pin 1 of chip R.

Z80s present a different type of problem: timing. The Altair was intended to work with 8080s, which generate pDBIN (a short timing pulse that indicates when the data is actually wanted on the data bus) in the CPU chip itself and buffer it to the pDBIN line. My Ithaca Audio Z80 CPU board creates a pDBIN signal by combining the Z80 RD and INTA; this pulse lasts for the entire read cycle. The 8080 pDBIN does not start until after the ending of pSYNC, which tells when the read cycle started. In some memory boards, this difference in pDBIN timing is unimportant, but not in the Altair memory boards. Refresh and

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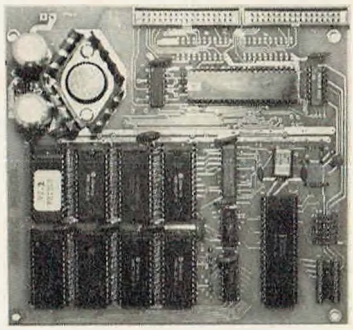

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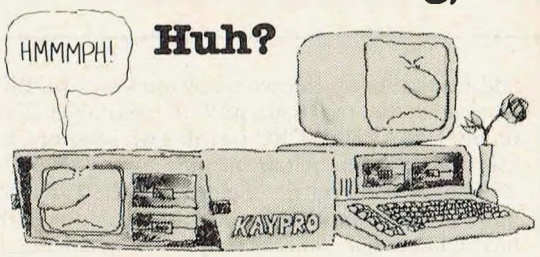

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CIRCLE 113 ON READER SERVICE CARD

address timing are thrown off by too long a pDBIN. I also discovered that the Ithaca pSYNC was only half as long as on my IMSAI 8080 CPU board. Two solutions are possible: 1) modify the Altair memory board, or 2) make the Z80 board conform more closely to the IEEE-696 standard. I tried both, and settled on modifying the CPU board, but either choice is simple to implement.

To fix the Altair memory, cut loose pin 4 of D (74LS20) from ground and connect it to pin 3 of X (74LS04). This disables the timing till after the end of pSYNC. The Altair board should run now; if it does not, check for bad chips.

Changing the Z80 board is a little more involved, but may be worthwhile if you use boards from different manufacturers. The solution is to feed pSYNC from chip 8 pin 6 to one input of an unused NOR gate on chip 10 and pDBIN to the other input. This delays the output till after pSYNC, but a small spike will be present at the initial crossover point. In the Ithaca Audio board, three chips are used for timing delay; putting the new NOR gate after the last delay helps reduce the spike but reverses the polarity. The further addition of an unused inverter in chip 17 increases the delay so that the spike is now below the triggering level, and pDBIN is of proper length and polarity. The pSYNC timing should be checked (RC values of U8 74121), as some confusion existed at Ithaca Audio when this board was designed. My schematic shows the value of capacitor C10 as 100 pfd, but the parts list gives 200 pfd. If your board has a 100 pfd capacitor, use a 6.2K resistor at R5; if the capacitor is 200 pfd, use 3.3K at R5 as shown in the parts list. Figure 3 shows all of the changes required on the Ithaca Audio Z80 CPU board.

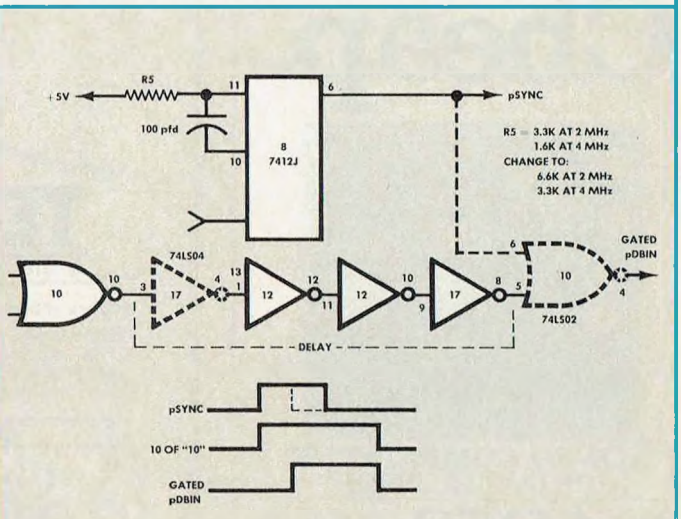

Figure 3. Ithaca Audio Z80 pDBIN circuit and changes, revision 1.0.

More quickies

There are several other points to inspect before this project is finished. Apparently noise was a problem at one time, for one of my boards had bypassing on chip V. The address lines coming into V all have 0.022 mfd bypasses, and there is more ground bussing at chip V. One of my boards did not have the extra ground bus, but worked fine without it. When the board without the extra ground bus was modified, problems appeared; they were solved by running a ground lead from pin 100 of the bus directly to the ground pin of chip V. This lead shortens the ground path back to the bus; it was originally rather long and circuitous. Another change that may be needed is to replace the HALTA input with RESET. This was done by cutting the connection between pins 2 and 3 of chip "T" and connecting pin 3 to pin 75, the RESET bus pin. Other changes were to move R/W from pin 8 of D to pin 13 of X; then connect pin 8 of D to pin 13 of E, POC line to pin 13 of A (not pin 99 of the S-100 bus), and pin 13 of D to pin 5 of E. The effects of these last changes are not really known, since the board will work without them. I have reviewed them only as items that I have seen implemented and that may help to get your board running.

However, a word of caution is needed: do not doubt your modifications. If a review of the changes you have made proves them correct and the board still will not work, start looking for other problems. Several times I went after problems in my design only to find bad chips in other boards. Check also the run/wait jumper for proper operation, usually W1 to W2. In using the 8T97, remember that this chip is a four-by-two buffer, not three-by-three, so use the pins listed. A 74367 can be substituted for a 8T97; a 74LS367 will sometimes work, but may not always have sufficient driving power. For this reason you should use 74367s only if you can not get 8T97s. 74125s were considered as a one-chip substitute for 8T97s, but as yet have not been tested. 74125s are 14-pin devices, whereas 8T97s are 16-pin devices, so that connection to ground and +5V would be difficult on the 74125.

Conclusion

The description and solution of problems and changes were specific to the boards described, but need not be so. While writing this article, it crossed my mind that many of these and similar "cheap memory" boards are sitting around on shelves just waiting to be modified and used—my next modification will be to use the bank decoder on address lines A16 and A17 for 8088 extended memory operations (256K of memory on four boards for $400!). In finding the solution to the problems a certain amount of intelligent probing was used, but trial and error also counted significantly.

The current cost of 16K chips is now below $2 in quantities of 100, and many manufacturers are being stuck with chips at the old prices still on their boards. These low prices should start a price war soon, to the buyer's benefit. Any person who, after reading this article, pays over $60 for 64K worth of 4116 chips (or $210 for 256K) is paying too much.

Kibler Electronics has a reprint of the original manual and schematics, as well as a reprint of this article with updates for using 4164s at 4 MHz for a 256K memory card. The reprints are available for $5 from Kibler Electronics, 2918 33rd St., Sacramento, CA 95817.

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Extended Memory Management: Addendum

The listing for "Extended Memory Management" by Andrew Bender (November 1983, p. 106) was inadvertently left out, and is reproduced here. We apologize for any inconvenience this may have caused.

Program to move data between banks

A demonstration program to test the bank select circuit is given below. This program moves data between banks and must always reside in the global portion of memory common to all banks. It is assumed that this program is called from another routine in global memory. The banks must be switched for each byte transferred. Note that a Z80 machine cannot use a block transfer instruction to move data between banks.

```
                        PUBLIC  XMOVE_MOVE
                        ;ENTER WITH HL=>POINTING TO WHERE STUFF TO MOVE IS
                        ;          DE=>POINTING TO WHERE TO MOVE IT TO
                        ;          B=>BANK TO MOVE IT FROM
                        ;          C=>BANK TO MOVE IT TO
                        ;          TOP OF STACK=>NUMBER OF BYTES TO MOVE (>0)
                        ;XMOVE: =>  MOVES BETWEEN BANKS BUT CHECKS TO SEE IF
                        ;           DESTINATION BANK IS SAME AS ORIGIN
                        ;MOVE:  =>  MOVES IN CURRENTLY SELECTED BANK ONLY
                        ;
00FD =                  MEMSEL  EQU     0FDH    ;MEMORY MANAGER OUTPUT ADDRESS
                        
0000 78                 XMOVE:  MOV     A,B     ;MOVE BETWEEN BANKS
0001 B9                         CMP     C       ;CHECK FOR SAME BANK
0002 CA2700                     JZ      MOVE1   ;NOT NECESSARILY CURRENT ONE
0005 320F00                     STA     OB+1    ;SAVE ORIGINATING BANK
0008 79                         MOV     A,C     ;GET DESTINATION BANK
0009 321800                     STA     ODB+1   ;SAVE IT
000C C1                         POP     B       ;GET COUNT (ON STACK ON ENTRY)
000D F3                         DI              ;DISALLOW ANY INTERRUPTS
                                                ;SO THAT BANKS CLOBBERED BY
                                                ;UNEXPECTED DATA
                        
000E 3E00               OB:     MVI     A,$-$
0010 D3FD                       OUT     MEMSEL  ;SELECT PROPER BANK FOR ORIGIN
0012 7E                         MOV     A,M
0013 23                         INX     H
0014 321000                     STA     XM1+1   ;SAVE BYTE FROM WRATH
0017 3E00               ODB:    MVI     A,$-$   ;DESTINATION BANK
0019 D3FD                       OUT     MEMSEL  ;SELECT IT
001B 3E00               XM1:    MVI     A,$-$
001D 12                         STAX    D
001E 13                         INX     D
001F 0B                         DCX     B
0020 78                         MOV     A,B
0021 81                         ADD     C
0022 C20E00                     JNZ     OB      ;LOOP TILL THEY ALL GET TRANSFERRED
0025 FB                         EI              ;TURN ON INTERRUPTS
0026 C9                         RET
                        
0027 F3                 MOVE1:  DI              ;AVOID A SURPRISE
0028 D3FD                       OUT     MEMSEL  ;SELECT PROPER BANK JUST ONCE
002A C1                 MOVE:   POP     B       ;GET COUNT OFF THE STACK
002B 7E                         MOV     A,M
002C 12                         STAX    D
002D 23                         INX     H
002E 13                         INX     D
002F 0B                         DCX     B
0030 78                         MOV     A,B
0031 81                         ADD     C
0032 C22B00                     JNZ     MOVE+1
0035 FB                         EI
0036 C9                         RET
0037                            END
```


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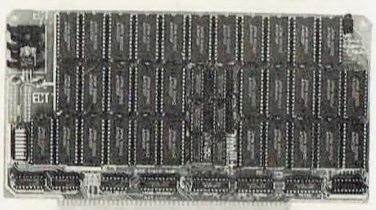

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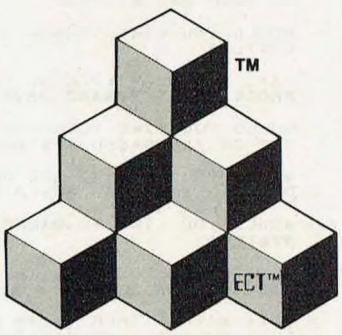

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Write or call for details of Q/C Version 3.1. Disk formats include 8-in. single density, KayPro, Osborne DD, Morrow, Televideo 802, and Apple CP/M. VISA and MasterCard welcome.

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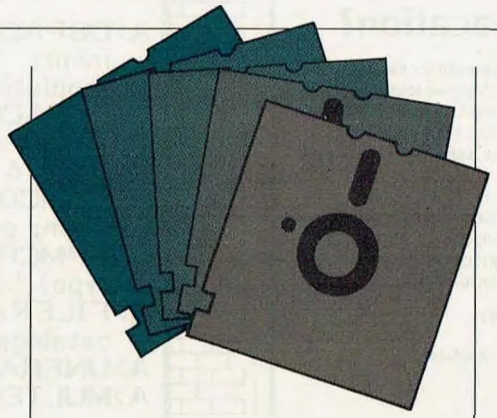
Software Directory

Program name: MBasic-to-Oasis Basic translator (MTRANS)
Hardware system: Any computer that can run under Oasis
Minimum memory: 64K in 8-bit; 320K in 16-bit
Language: Oasis Basic and Oasis Exec
Description: MTRANS is a utility that converts Microsoft Basic programs to executable Oasis Basic with little or no programmer assistance. When translated, all programs automatically support Oasis' multiuser functions, including automatic record locking and optional file locking. MTRANS displays each line of program text on the CRT screen as it is being converted, and informs the operator of any difficulty or errors in a brief report which may be written to a sequential file or printed on an attached printer. Errors are also clearly flagged.

To accommodate the various versions of MBasic, MTRANS permits the operator to add, change, or delete items in the replacement table. A renumbering feature converts line numbers during the first pass of conversion, automatically splitting long lines as needed for logical execution. In addition, MTRANS enables the operator to enter the dimensions of the screen used by the original program and then reconfigure the size to accommodate virtually any CRT.

The key element of MTRANS is a subroutine generator which allows the file-handling logic of Microsoft Basic to be used under Oasis.
Price: 8-bit version of MTRANS, $245; 16-bit version (soon to be released), $345.
Included with price: MTRANS on appropriate disk, documentation, full reference guide, and technical support from Phase I.
Available from:
Phase One Systems, Inc.
7700 Edgewater Drive, Suite 830
Oakland, CA 94621
(415) 562-8085
CIRCLE 321 ON READER SERVICE CARD

Program name: 8086 OS converter
Hardware system: PC-DOS (MS-DOS), CP/M-86
Language: Object code
Description: The OS converter, produced by Dynamic Microprocessor Associates, permits PC-DOS (MS-DOS) object code to run on CP/M-86 microcomputers, and enables CP/M-86 object code to run on MS-DOS systems. Use of the OS converter involves no loss of speed, and will permit users to run such programs as Microsoft Basic and Fortran, Digital Research Pascal and other language compilers, as well as utilities like Microsoft ASSEMBLER and LINKER.



The new program operates by loading a target program into memory and creating the environment that the program expects. There is no interpretation of instructions; the program itself remains in control of operations.

The OS converter is 4K in size. When in use, it resides just above the operating system in RAM and enables the program being run to take full advantage in available memory. The OS converter for the IBM PC is supplied with a companion program that enables PC-DOS systems to read CP/M-86 files.
When released: May 1983
Price: $95
Available from:
Dynamic Microprocessor Associates, Inc.
545 Fifth Ave.
New York, NY 10017
(212) 687-7115
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Program name: Database System
Hardware system: CP/M Plus
Minimum memory: 241K
Language: CB-80
Description: Tarbell Electronics has introduced an improved Database System for CP/M Plus. This system's added functions include multiline field type, multilevel sort, nested IF-ELSE, and user-creatable menus. DBQUERY now has features that were previously available only in the DBREPORT module. ATTACH and DETACH commands for MP/M printers are new, and it is now possible for several users to append data to the same file, with all data intact.

Nested IF-ELSE-ENDIF for command files are now part of DBQUERY and DBREPORT. New functions in both are upper case, ASCII character, length and index.

The entire system is more user-friendly. In the new Tarbell Database System CP-80, overlays are now used instead of .COM files for modules. This saves disk space, improves loading time, and allows sharing of common variables between modules.
Price: Complete system in ready-to-run form, $100; source code in CB-80, $200. Updates: $25 for database system only; $50 including source code.
Available from:
Tarbell Electronics
950 Dovlen Place, Suite B
Carson, CA 90746
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Program names: TRAKSPLAYER and TUNINGS
Hardware system: Soundchaser computer music system, Apple II+, Apple IIe, Franklin Ace 1000
Minimum memory: 48K
Description: Passport Designs, Inc. has added two new utility software packages to its software list. TRAKSPLAYER and TUNINGS allow Soundchaser users to greatly expand their musical imagination and enjoyment. TRAKSPLAYER is a "record player" program for four-track composition. It allows the user to produce albums by creating four-track musical selections. They may then be played back in any order and repeated as many times as desired. Simply by loading the tracks into TRAKSPLAYER and organizing the playback, an album is produced. This utility also takes advantage of improved DOS and compressed file formats.

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Program name: WS-Patch
Hardware system: CP/M 8" SSSD, 5¼" Osborne, Kaypro, Morrow, North Star, Epson QX-10, Apple (CP/M) card. MS DOS 5¼" IBM PC and compatibles.
Language: Machine Code
Minimum memory: 64K
Description: Enhancement program for WordStar enables the user to access all of his dot matrix printer's capabilities through WordStar. WS-Patch also revises WordStar's print menu to include the new printing commands. Depending on the type of printer, WS-Patch may enable wide and condensed type, letter quality printing, continuous underline, sub and superscript, italics font elite, doublestrike, triplestrike, proportional spacing and various combinations. Programs available for Epson and Epson-compatible printers, Okidata microline printers and CITON prowriter printers.

WS-Patch documentation comes on the program disk. The documents print out of the user's printer. The file (a standard WordStar file) can be edited to see how the print commands are entered in the file and how they will print out.
When released: February 1983
Price: $49.95
Included with price: appropriate disk, instructions, document file. IBM version includes WS-KEYS, a utility program that redefines the IBM function keys in WordStar.
Available from:
CMB3
P.O. Box 3061
Walnut Creek, CA 94598
(415) 372-7733
CIRCLE 325 ON READER SERVICE CARD

Program name: Security, Security-Plus, Security-Plus-Log
Hardware systems: CP/M-80/86 or MP/M-80/86 system
Language: 8080 Assembler
Description: Security gives password protection to all files on a disk with no modifications to the operating system; Security-Plus allows individual programs to be protected against unauthorized access; Security-Plus-Log additionally maintains a complete record of program and file activities.

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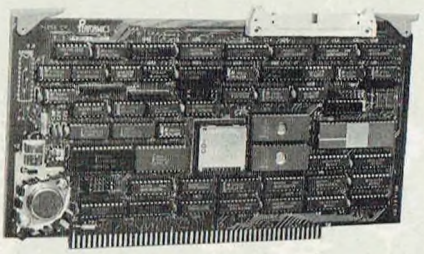

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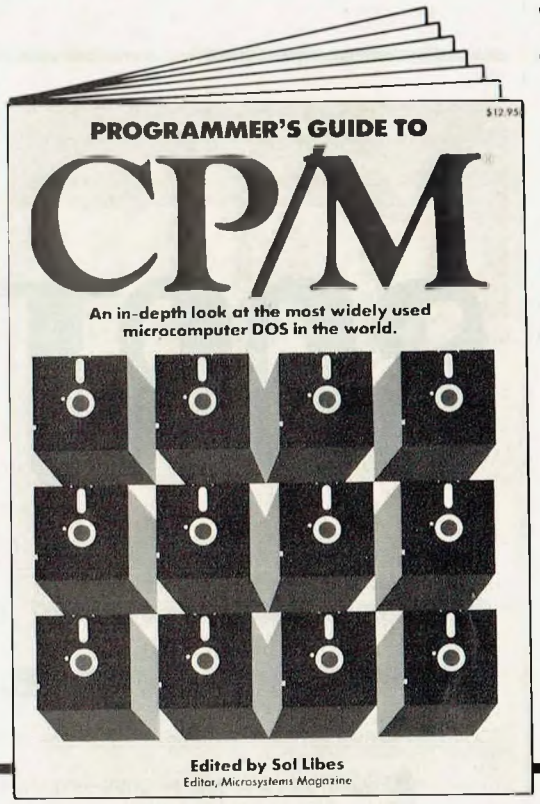
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Software Directory continued . . .

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Price: Security, $50; Security-Plus, $100; Security-Plus-Log, $150; demonstration disk, $25.
Included with price: Documentation
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Program name: FINANCIAL UTILITY I
Hardware system: Osborne or MS-DOS
Minimum memory size: 64K
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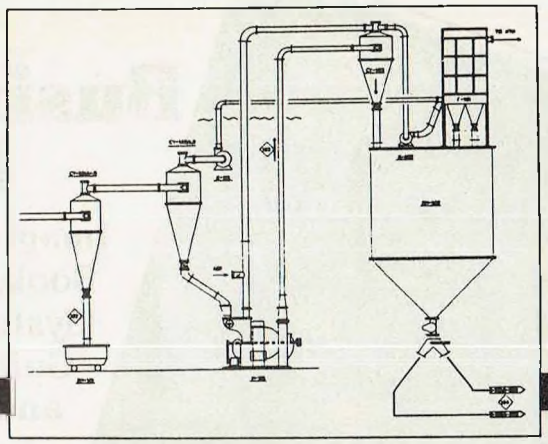

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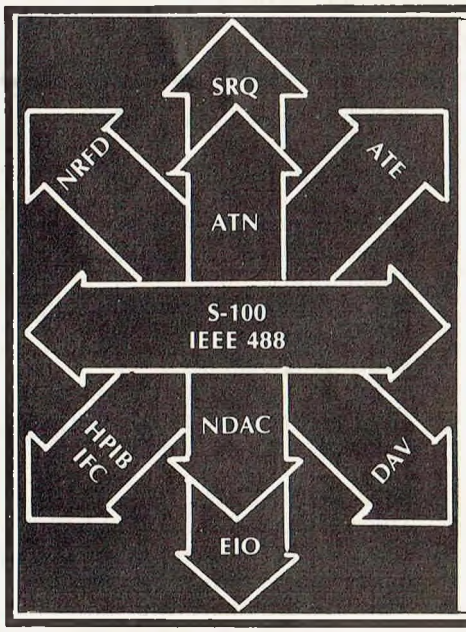

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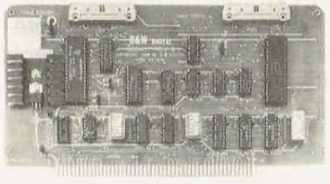
IEEE-488

IEEE 488 TO S-100 INTERFACE



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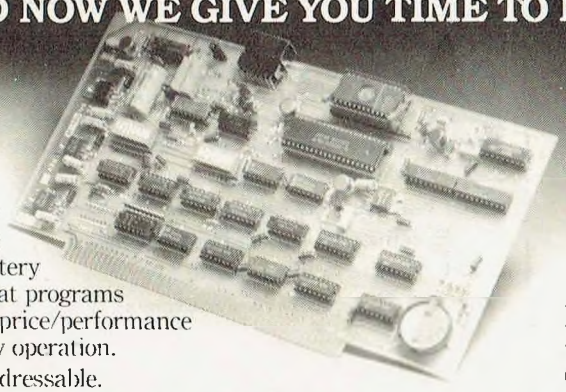

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Program name: MagicIndex
Hardware system: any CP/M microcomputer
Minimum memory: 48K
Language: Assembly
Description: MagicIndex automatically compiles, alphabetically sorts and prints index entries, table of contents and other similar lists, with the following additional features: • index entries can be marked from the text itself; • common prefixes and suffixes can be automatically converted to lower case without affecting the textual contents (the first letter of each word in an entry can also be capitalized, or the entries can appear just as in the text, without any case conversion; • "see also" or other commentary entries can be appended to the main entry, or new entries that do not appear in the text can be specified; • entries can be collected or viewed on screen while printing the main text; • table of contents entries can be compiled automatically when auto-numbering symbols are used to designate chapters and sections, and can also be marked manually in the same way as index entries; • the compiled list can be modified or re-edited before printing; • index entries can be printed in one or more columns, with or without page headings and footings.
When released: December 1983
Price: $150
Included with price: Program disk and documentation
Available from:
Computer EdiType Systems
509 Cathedral Parkway, #10A
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(212) 222-8148
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Program name: Real-Time C Run-Time Library for use with code generated by Whitesmiths C compiler.
Hardware system: 8080, 8085, or Z80 CP/M 2.2, CP/M Plus, or MP/M II, Whitesmiths C compiler (not for Release 2.0)
Minimum memory: Depends on use
Language: Assembler, some C
Description: Real-Time C is a runtime library that may be included in distributed programs without royalties. It has enhanced error checking and recovery, and is suitable for real-time programming. Portable I/O conventions are fully supported.

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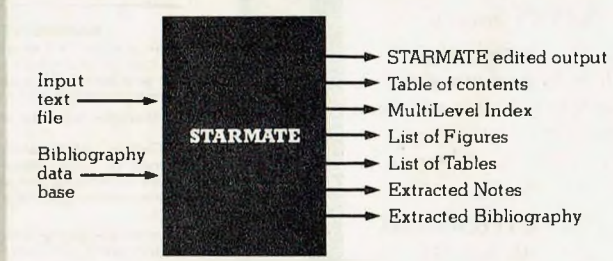

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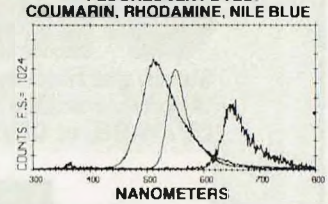

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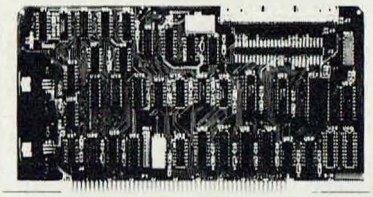

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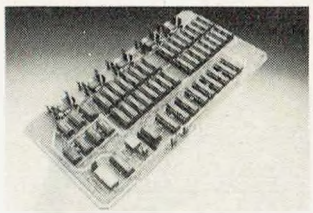

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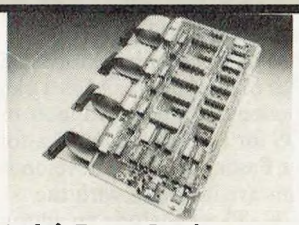

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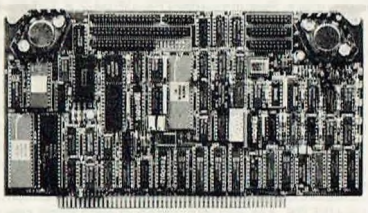
New Products

VFW-III peripheral controller

SDSystems, Inc., has announced their VFW-III peripheral controller for the IEEE-696 (S-100) bus. The VFW-III is a single-board controller for floppy and Winchester disk drives that complies fully with the IEEE-696 standard. The board supports simultaneous use of up to three 5¼" Winchester drives and four 5¼" and 8" floppy disk drives in any combination. The VFW-III is the only S-100 bus controller to offer these capabilities on a single board.

The Winchester interface is the industry standard ST 5506/412, which allows systems integrators to select Winchester drives from the majority of manufacturers. Floppy drives may be single or double sided, single or double density—further adding to the flexibility of the VFW-III.

High performance is assured with variable-length sector buffers, and DMA or programmed I/O control. Floppy disk operations include a phase-lock-loop data separator and write precompensation logic for data integrity. Winchester disk reads utilize single- and double-bit burst error detection and single-bit error correction to ensure data integrity. The VFW-III is a multilayer card with full power and ground planes for superior noise immunity.



Suggested retail price: $895.

SDSystems, Inc., *P.O. Box 28810, Dallas, TX 75228; (214) 340-0303.*

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Basic SBC

A single-board computer suitable for OEMs and system developers has been released by Dysys, Inc. With 48K of mixed memory, a 6801-compatible CPU, 33 input/output lines, a UART, timer, and diagnostic LEDs, the BRICK (Basic Realtime Integrated Controller Kernel) will handle nearly all monitoring and control tasks.

The BRICK uses 2K, 4K, and 8K memories. RAM, EPROM, or EEPROM may be inserted into any socket. Dual address decoders enable you to use different sizes of memory ICs and still preserve contiguous memory blocks.

The board is available for the STD bus, for prototyping, and as a plug-in component. It is also available in CMOS for low-power applications. Either Pascal or Forth development systems are included with the BRICK. These include an editor, compiler, interpreter, and runtime support.

Dysis, Inc., *961 South Bland St., Halifax, Nova Scotia, Canada, B3H 2S6; (902) 423-5308.*

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Floating point processor

The SKY Fast Floating Point Processor (SKYFFP) is a single-card, high-speed processor that performs 32-bit and 64-bit floating point operations at many times the speed of the host CPU alone.

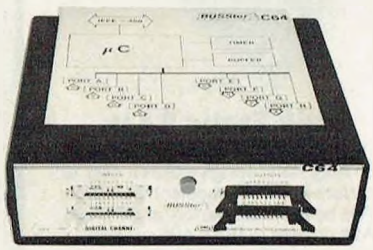
The SKYFFP performs basic arithmetic operations such as add, subtract, multiply, and divide as well as more complex procedures such as square roots, logarithms, and trigonometric functions on IEEE-compatible 32-bit single-precision and 64-bit double-precision floating point data.

Operationally, the SKYFFP is user transparent. Users simply plug in the SKYFFP and integrate it with the SKY patch kit, the operation of SKYFFP requires no modification to existing programs in Fortran or other support languages.

For special processing needs, users may microcode the SKYFFP to implement special algorithms or iterative tasks to obtain higher speeds that are executable with a single SKYFFP instruction. The SKYFFP is particularly well suited for systems and processors based on the MC68000 and designed for use on the MULTIbus, VERSAbus, VME bus, and S-100/IEEE-696 bus.

The use of SKYFFP requires no explicit coding actions on the part of the Fortran programmer. All linkage between the Fortran program and the SKYFFP can be accomplished through a set of runtime library modules supplied by SKY for the particular compiler/operating system being used.

The SKYFFP is installed directly into the bus backplane, occupying one slot, and typically requires 4.0 amps at +5V DC. The SKYFFP is referenced by the system CPU through a set of preset PALs or registers whose bus addresses are jumper selectable. These addresses



are factory set to be consistent with the factory-supplied software, but may be changed by the user to avoid system conflicts in his particular configuration. Any jumper base address change, however, must be followed by a corresponding change to the base address assumed by the support software.

Price: $220 in single quantity; OEM discounts available.

SKY Computers, Inc., *Foot of John St., Lowell, MA 01852; (617) 454-6200.*

CIRCLE 312 ON READER SERVICE CARD

IEEE-488 64-line I/O module

Connecticut microComputer has announced a new digital 64-line I/O module that is a self-contained IEEE-488 (GPIB) bus compatible device. Called the BUSSter C64, it works with any computer that has an IEEE-48 interface (either built in or added on), including computers manufactured by Apple, IBM, Commodore, Osborne, Hewlett-Packard, and Tektronix.

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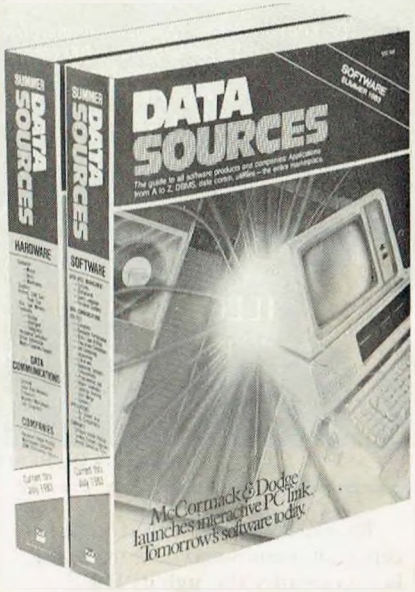

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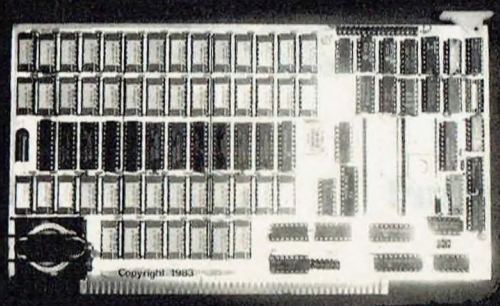

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- NEC 7220D-1 VLSI Graphics Controller draws arcs, lines, circles at 800ns/pixel.
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- "C" Language driver-source included.
- On board 8749-8750 offers local intelligence.

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- 4096 and 16 million color personality boards
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- Ultra High Speed Video — 60 Mhz.

The Illuminated Technologies single board color graphics controller promises to revolutionize high performance S100 color graphics.

From a cost effective monochrome configuration, users can expand to a powerful RGB color system with 256 colors selectable from a 16 million color palette. The onboard 8749 microprocessor (available 1Q84) provides system integrators with local console support functions.

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The BUSSter C64 I/O Module accepts commands and data from any host computer through its IEEE port, to read or write 64 digital TTL-level lines (32 in/32 out). The built-in timer operates from 0.01 seconds to 48 hours. The built-in buffer allows data acquisition while the host computer is busy with other tasks. The BUSSter C64 module economically increases a computer's interfacing capability while reducing its workload. It is easily programmed through Basic commands from the controlling computer.

Price: $495 in standard version, including case and power supply.

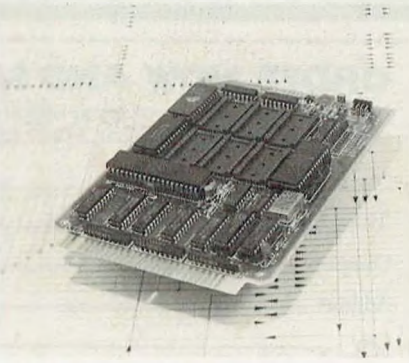
Connecticut microComputer, Inc., *36 Del Mar Drive, Brookfield, CT 06804; (203) 775-4595.*

CIRCLE 313 ON READER SERVICE CARD

STD Bus CPU

STD Microsystems Model 5320A is a STD Bus CPU featuring a Z80 microprocessor, onboard counter/timer (CTC), and fully buffered signals for maximum expansibility. The module accepts up to 16K of RAM/ROM/PROM/EPROM/EEPROM, which may be freely intermixed without module reconfiguration. The design allows user-modifyable control of memory and interrupt acknowlege wait states. The CTC has four channels that may be independently programmed for frequency/event counting, timing, or interrupt generation. Bidirectional address, data and control buses permit DMA to onboard memory and I/O.

STD Microsystems is a manufacturer of STD bus modules for the professional design engineer. The



company has developed a complete line of Z80 single board computer modules for a very usable variety of component applications. Currently in development are applications using state-of-the-art CPU and peripheral component developments.

Prices: for STD Bus Z80 CPU: 2.5 MHz, $195; 4MHz, $225; 6MHz, $255. OEM prices available.

New Products
continued . . .

STD Microsystems, *399 Sherman Ave., Palo Alto, CA 94306; (415) 327-6800.*

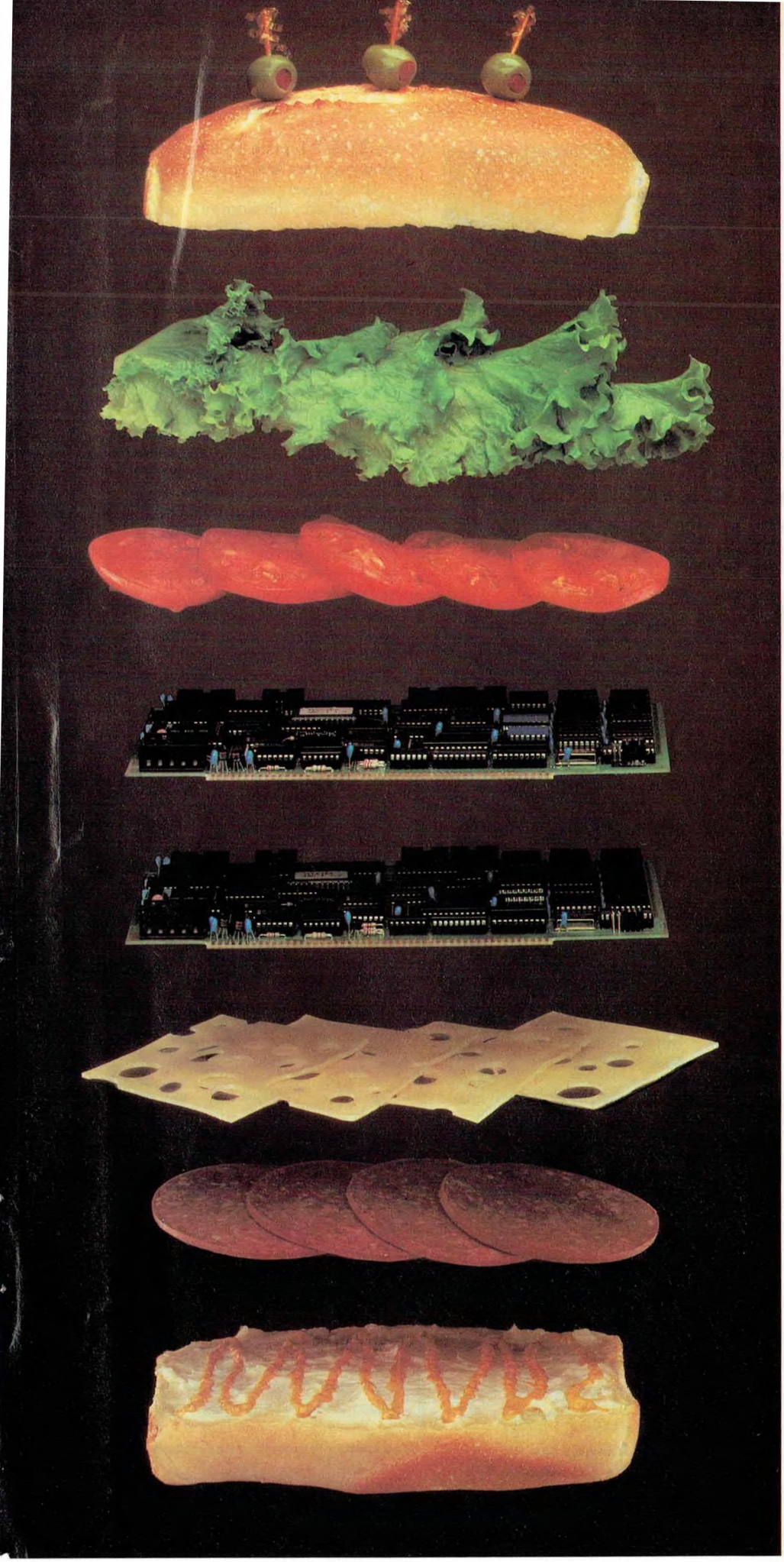
CIRCLE 314 ON READER SERVICE CARD

S-100 peripheral computer

Abacus Technology Systems, Inc., has announced its PDP/11-compatible peripheral computer, the PC11, for S-100-based computer systems. The unit offers a very cost-effective way for S-100 users to take advantage of the vast amount of quality PDP/11-based software that has been created over the past decade. The PC11 is a T11 microprocessor-based unit with 64K of onboard memory. The unit plugs into existing S-100-based computers and uses the existing processor and peripherals for I/O. The PC11 package includes the DEC RT11 operating system and an I/O interface program which supports the console, printer and dual disk drives. 8" soft-sectored disks allow media compatibility with DEC PDP/11 series minicomputers for program interchange. The I/O interface program and PC11 hardware are structured to allow the addition of peripheral devices not supported by the basic I/O interface program.

The PC11 does not impact the normal operation of the S-100 computer. The S-100 software is written in 8080 assembly language and runs under CP/M versions 1.4 or 2.2. The software requires a minimum program area of 10K and the standard BIOS routines utilized directly for I/O. The PC11 software is written to support 8" single-density soft-sectored disks.

Price: The PC introductory price is $795, including RT11 operating system and CP/M-based I/O interface program source supplied on 8" floppy disk media.



Teletek's New Combo Could Make You A Hero!

The SBC-II could be just the right ingredient for your latest concoction. The newest member of Teletek's family of multi-user, multi-processing S-100 products, the SBC-II essentially combines, or "sandwiches" two Teletek SBC-I's into one board. The SBC-II provides the capability to support two users from one standard size IEEE-696/S-100 slave board.

The SBC-II maintains full performance for each user with an independent CPU (Z80A or Z80B), 64K RAM, Serial I/O, and FIFO communications port to the system master. The system integrator benefits by getting complete support for two users for the price of one board.

TurboDOS and MDZ operating systems will support combinations of SBC-I's and SBC-II's offering system design efficiency and flexibility never before possible.

If you're hungry for value and efficiency, order an SBC-II from Teletek. You'll love every byte.

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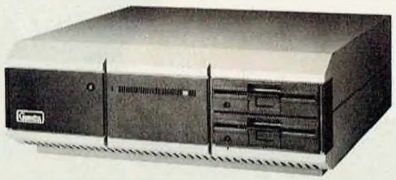
Abacus Technology Systems, Inc.,
8343 Carvel, Houston, TX 77036;
(713) 777-0401
CIRCLE 315 ON READER SERVICE CARD

New business computer

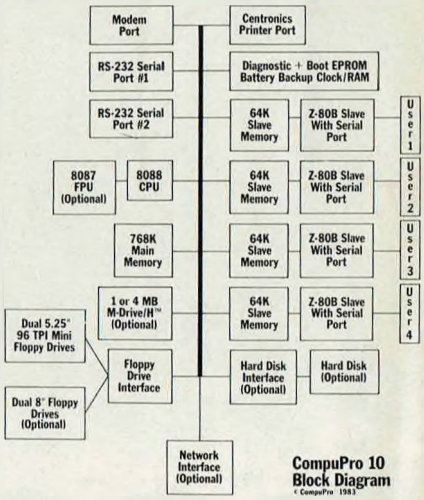
The CompuPro 10, a new four-user multiprocessor microcomputer system, features concurrent execution of both 8- and 16-bit industry-standard software. It is the first in a series of cost-effective, high-performance CompuPro business computers that departs from the company's tradi-



tional IEEE-696 orientation. The compuPro 10's multiuser, multiprocessor design represents a significant achievement in microprocessor architecture because all system resources are potentially available to all users at any time, and they can run both 8-bit and 16-bit programs from any terminal transparently.

In its closely coupled master/slave architecture, the CompuPro 10 uses a dedicated central 8088 processor to handle system resources and overhead such as disk, printer, and communication links, while four Z80B processors act as individual task processors. Since these slave processors are freed from system overhead, their performance approaches that of a single-user system. By using the closely coupled architecture, the CompuPro 10 yields higher throughput and performance than the loosely coupled alternatives, primarily because of functional differences in interprocessor communications.

In the standard CompuPro 10 configuration, each user terminal has access to its own Z80B processor and dedicated memory for running 8-bit applications programs. The central 8088 processor and its main memory are dynamically allocated to each user, with the Z80B acting as a "terminal handler" for running 16-bit tasks. Standard features include



CompuPro 10 Block Diagram

an 8 MHz 16-bit 8088 central processor with 768K of main memory, several serial ports (including a modem port), a Centronics printer port, 384K of solid state disk memory, and dual 96 tpi $5\frac{1}{2}$" floppy disks storing 2 MB. In addition, there are four 8-bit Z80B user processors, each with its own 64K RAM, in the compact 7" × 17" × 21" unit.

The fully integrated package allows concurrent multitaksing operation of both 8-bit and 16-bit programs under an enhanced version of

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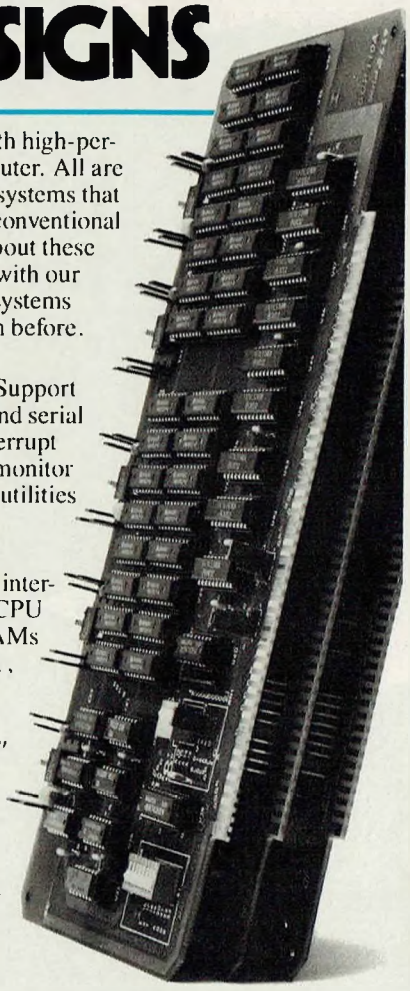

You can unlock new system capabilities with high-performance S-100 boards from Seattle Computer. All are IEEE-696 compatible. But, for innovative systems that demand performance beyond the limits of conventional S-100 boards, you'll want to know more about these Seattle Computer products. For example, with our 8 MHz 8086 CPU, you'll be able to build systems that run faster and consume less power than before. Take a closer look:

8086 CPU Set: 8 MHz 8086 CPU • CPU Support board includes a console serial port, a second serial port, Centronics parallel port, vectored interrupt controller, four 16-bit timers and EPROM monitor for 8086 • MS-DOS 2.0 plus development utilities • 8087 numeric coprocessor is optional • **Single Qty: $595.00**

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Multi-Port Serial Card 2- and 4-port versions are available • These RS-232 ports operate as either "data sets" or "data terminals" • 36" cables included • **Single Qty: $280.00 (4-port) $210.00 (2-port)**

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The MATCO Eprom Emulator/Programmer EMPROM-1 is a sophisticated tool designed to support the software engineer who routinely develops Eprom-based applications. It will emulate and/or program any of the currently available five-volt only MOS and CMOS Eproms from the 2758 at the low end to the 27128 at the high end. The primary features are:

- Compatible with IEEE 696 S-100 standard
- I/O mapped—consumes no system RAM space
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- Zero insertion force programming socket
- Complete with software: ■ runs under CP/M*, MP/M*, or CDOS** ■ menu driven program supports both programming and emulation ■ limited debugger type functions are provided ■ supplied in source code on 8" single sided soft-sectored disk.
- Incorporates the Intel fast programming Algorithm
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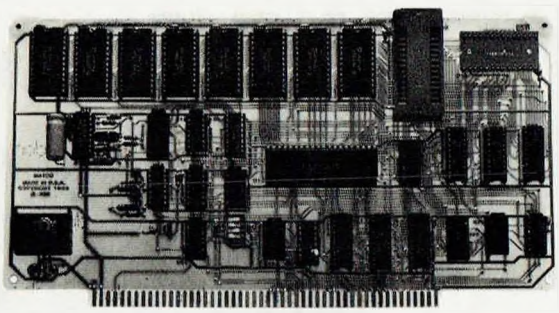

Board with zif socket	**$349.00**
Board without zif socket	**$339.00**
External programming module + 3' cable	**65.00**

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CompuPro's MP/M 8/16, and industry-standard CP/M-based operating system that enables users to access more than 3,000 business application programs. In addition to MP/M 8/16, the CompuPro 10 comes bundled with a selection of financial spreadsheet and word-processing applications programs, as well as a sophisticated database management system. CompuPro will also offer local area network options compatible with most popular network schemes by the end of 1983.

The CompuPro 10 is covered under the company's 12-month warranty, beginning on the day the product is purchased from a dealer. The warranty includes nationwide on-site maintenance through the Xerox Service Group's Americare third-party service program.

Price: $4,995, excluding terminals.

CompuPro, *3506 Breakwater Court, Hayward, CA 94545; (415) 786-0909.*

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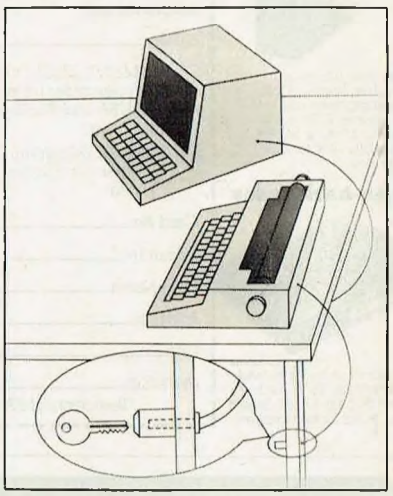
Security lock for small computers

Maxton Lock Company, Inc., introduces the Maxton Cable Lock, a security device that guards against theft of small computers and word processing equipment, yet allows the equipment to be moved freely.

The new model MIC secures equipment with a 5′ vinyl-covered aircraft cable and a pick-resistant,



free-spinning lock. Both the cable and lock attach to a workstation or table leg to avoid drilling on work surfaces. Unlike stationary locks, the Maxton Cable Lock allows machines to be easily moved, yet provides maximum security.

The small computer boom has re-

"Q-PRO 4 blows dBASE II away

We now complete complex applications in weeks instead of months."

says Q-PRO 4 user, Richard Pedrelli, President, Quantum Systems, Atlanta, GA

"As a dBASE II beta test site the past two years, we were reluctant to even try Q-PRO 4. Now we write all our commercial applications in Q-PRO 4. We find it to be an order of magnitude more powerful than dBASE II.

We used Q-PRO 4's super efficient syntax to complete our Dental Management and Chiropractic Management Systems much faster. Superb error trap and help screen capabilities make our finished software products far more user friendly, too.

In my estimation, any application programmer still using outdated 3rd generation data base managers or worse, a 2nd generation language like BASIC, is ripping himself off."

Runs with PCDOS, MS-DOS, CP/M, MP/M, CP/M86, MP/M86, TurboDOS, MmmOST, MUSE, and NSTAR.

PRICE: 8-bit single-user – $395; 8-bit multi-user and 16-bit single-user – $595; 16-bit multi-user – $795.

Money-back guarantee • Author's lock up package available • Finished applications are freely transportable between operating systems • Multi-user with true record and file lock.

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cently created a lucrative new industry for thieves. Small computers are easy targets for burglars, both in the home and business. No thief will think twice about the fact that the equipment may contain the entire records of a household or business. The records have no resale value, so the loss may be irreplaceable. It is estimated that fewer than 1% of the small computers in use today use a security locking device.

Price: $35

Maxton Lock Company, *401 East 74th Street, New York, NY 10021; (212) 628-4222.*

CIRCLE 317 ON READER SERVICE CARD

Database membership for Apple users

Apple II users can now obtain a free, permanent subscription to The Source, a leading database resource, when they purchase the Network modem for $129.

The Networker, from Zoom Telephonics, Inc., is a single-slot, 300-baud modem designed for Apple II, II+, and IIe computers. It combines complete modem functions and Apple communications circuitry on one card while providing direct, low-noise, modular telephone connections. A disk with the required communications software is also included.

The Source, Inc. (McLean, VA), is one of the largest communications and information networks available to personal computer users. It offers electronic mail service as well as access to hundreds of computer bulletin boards. Many business and financial databases, travel and reservation services, consumer services, games, and more are also offered. The Source is accessible with a local phone call in 500 major metropolitan areas. Registered members buy services at an hourly rate. Zoom Telephonics' membership offer is valued at $80.

Packaged product information will instruct purchasers where to contact The Source, register their membership, and obtain details on the database's services. For information on where to obtain the Networker, contact **Zoom Telephonics, Inc.,** *207 South Street, Boston, MA 02111; (617) 423-1072.*

CIRCLE 318 ON READER SERVICE CARD

Voice products by Texas Instruments

Texas Instruments has announced the availability of two speech recognition and synthesis products for the TI Professional Computer. A turnkey application package, Speech Command™, makes speech immediately available as an input or output technique for existing applications. A Speech Command development kit allows incorporation of speech capabilities into software developed by third parties.

The Speech Command application package includes a plug-in hardware package that accepts voice commands and also allows the TI Professional Computer to deliver vocal feedback. The Transparent Keyboard™ feature of the Speech Command software allows verbal communication with the computer, in addition to regular keyboard input. Speech Command software also offers sophisticated telephone management capabilities that allow the sys-

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New Products
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tem to record incoming phone messages, dial numbers, deliver outgoing phone messages, and provide playback of recorded messages that can be actuated from a remote telephone.

All of the voice processing is performed using TI's high-speed TMS 320 digital signal processor to perform real-time voice analysis and synthesis. The telephone interface is performed with another TI processor chip, the TMS 7000. The Speech Command hardware consists of two boards, arranged piggyback so that they use only one option slot in the TI Professional Computer.

The Speech Command system can be used by professionals and business executives in a variety of ways, including:

- to evaluate data quickly. The TI Professional Computer responds to a verbal command and provides the data requested. One spoken word can replace up to 40 manual keystrokes.
- to record phone messages. Messages are recorded at 2400 bits-per-second. The speech patterns are converted to digital data and available for playback later.
- to update and maintain a daily calendar. The system has a "tickler" portion for setting up agendas and scheduling appointments.
- for telephone management. For example, to redial a busy phone or to distribute prerecorded messages automatically.
- as a standard dictation machine.

The connected word recognition capability of the Speech Command system allows the user to speak in a conversational manner without pausing between words. TI's Speech Command system recognizes vocabularies of up to 50 words each. The number of vocabularies resident on the disk is only limited by the amount of mass storage on the system. In addition, a real-time, easy-to-use vocabulary switching mechanism allows you to quickly access different vocabularies. The voice coding feature, which converts human speech into digital values for storage and playback, uses a unique system that stores up to 16 minutes of speech on a standard 320K disk—up to 4 hours on a 5 MB Winchester disk and 8 hours on a 1 MB Winchester disk.

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- Includes definitions to translate Z80 to 8080 mnemonics and vice-versa, and definitions to implement CSAL, a C-structured assy. language, allowing code like *add a,(hl)* to be written *a+=*hl.*
- XLT users can pool their definitions via the XLT Users Group.

XLT costs 39.95 plus 5.00 P&H. For CP/M 2.2 8" single density disk Z80 systems.

Send check or money order to:

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TI's Speech Command is speaker dependent. Speaker dependancy improves recognition accuracy because the user trains the computer to specifically understand his voice. It accepts voice inputs and provides voice output via a speaker, headset, or telephone.

The Speech Command system can be integrated with any TI Professional Computer MS-DOS software program. For the most effective use of the Speech Command system the user's TI Professional Computer should have 256K of memory. Mass storage requirements are flexible. The products will perform with a single disk drive, dual disk drives, or a Winchester disk and single disk drive configuration.

The Speech Command package includes two piggyback circuit boards, a headset, a user's manual and two software diskettes, an installation/diagnostics guide, a diagnostics diskette, and a telephone cable.

Suggested list price for complete kit: $2,600.

Texas Instruments, Data Systems Group, *P.O. Box 402430, H-678, Dallas, TX 75240; 1 (800) 527-3500.*

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The basic computer features 256K of memory, two 320K floppy disk drives, a printer, a serial port, and a monochrome CRT display. A larger capacity hard disk, starting at 10MB, can be added as the user's needs grow. The computer may be linked to other micrcomputers via data communication network systems to provide fast, low-cost transmission of information.

COMET was developed by Seaworthy Engine Systems, Inc., Essex, CT, in cooperation with MMS.

Price: $20,000 and up. Hardware is customized to ship's characteristics; software is general purpose. Runs on IBM PC or HP-86, and allows satellite communication via Hayes Smartmodem.

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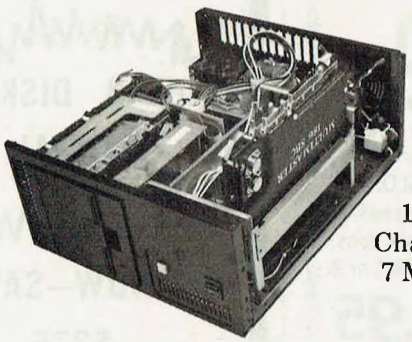

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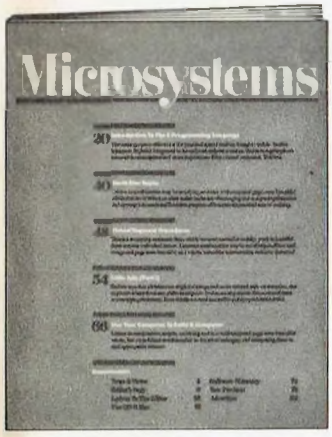

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Quite simply, our single board computers, slaves, 256K memories and personality boards let you build a system *now*, not later. The hardware works, the software works, and the prices are what you'd expect from a company that uses the most advanced design, software and production techniques to keep costs down.

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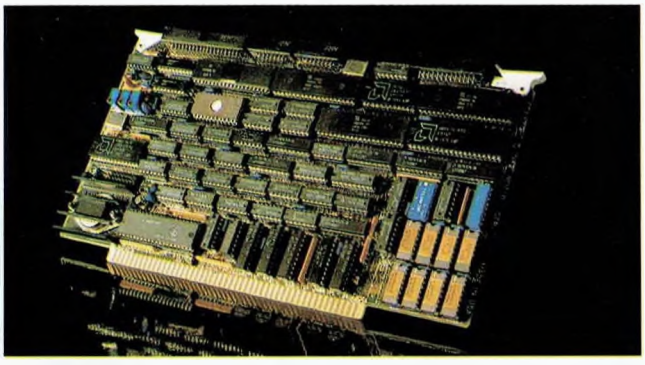
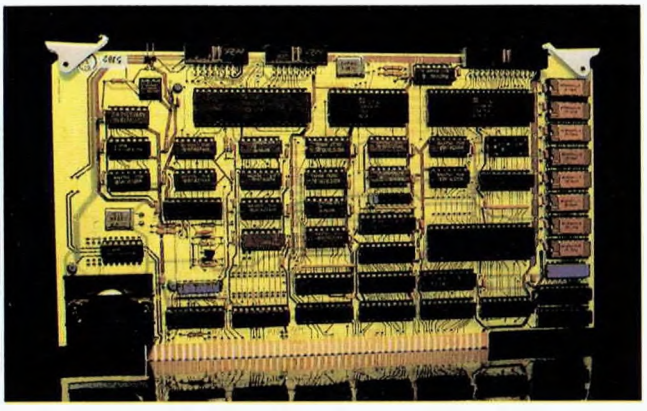
So stop messing around with multiple sourcing, hardware integration problems and software nightmares. Come to Intercontinental Micro and get it all — price, performance and delivery.

Read the specs, then call, write or circle the bingo number below. We'd be glad to send more information and help solve your S-100, multi-user system problems.



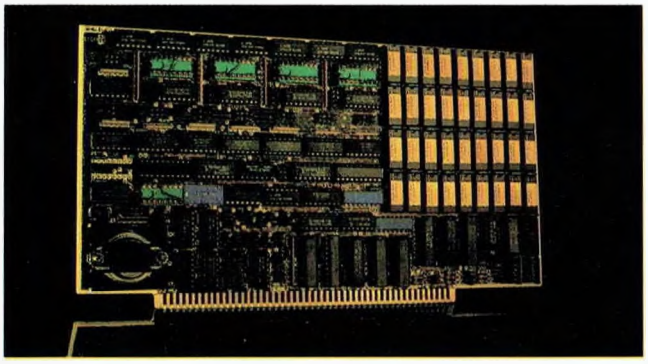
1 CPZ-48000 SINGLE BOARD COMPUTER.

☐ IEEE 696.1/D2 S-100 compliance. ☐ Z80A,™ 4MHz Operation. ☐ Floppy disk controller (FDC). Single or double sided. Single or double density. 8" or 5¼." ☐ Two synchronous or asynchronous serial I/O channels (SIO). ☐ Two parallel I/O channels (PIO). ☐ Four channel DMA controller. ☐ 64K on board RAM. ☐ Memory management unit (MMU). Addresses up to 16 megabytes of system memory. ☐ Eight Vectored priority interrupts. ☐ Provisions for 2K or 4K onboard EPROM. ☐ Software selectable baud rates. ☐ IBM Bisync, HDLC, SDLC and other protocols. ☐ CP/M,™ MP/M,™ and TurboDOS™ operating systems available. ☐ Turbo-Disk™ implementation included.



2 CPX-MX SLAVES.

☐ IEEE 696.1/D2 S-100 compliance. ☐ Compatible with CPZ-48000 SBCP, any Z-80A based CPU with extended address capability or 16 bit based CPUs complying with IEEE 696.1/D2 bus specification. ☐ Z-80B™ 6MHz (CPS-6X) or Z80A 4MHz (CPS-4X) operation. ☐ Two synchronous (CPS-MS) or asynchronous (CPS-MA) serial I/O ports. ☐ TurboDOS™ & CP/NET™ compatible. ☐ Master confiscation of slave memory for diagnostic purposes. ☐ Two parallel I/O ports; eight data bits + 2 handshake lines per port. ☐ 64 Kbytes of onboard dynamic RAM. ☐ Master/slave memory-to-memory transfers under DMA control @ 571 Kbyte/sec transfer rate when used with CPZ-48000 SBCP. ☐ Software selectable baud rates. ☐ Usable as an intelligent I/O processor in single user system.

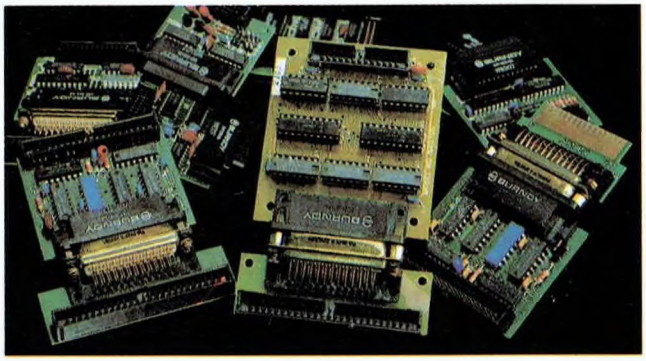


3 256KMB-100 256K MEMORY.

☐ IEEE S-100 bus, spec 696.1/D2 compliance. The 256KMB-100 is compatible with most IEEE S-100 board products now on the market. ☐ Linear addressable to 2 megabytes. ☐ 225 nano-second access time, maximum, 160 nano-seconds, typical. ☐ 295 nano- second read-write time, minimum. ☐ Bank selectable 16K increments. ☐ I/O port address bank selection. ☐ Configures for phantom deselection. ☐ Parity error detection, visual and/or interrupts. ☐ Bank selection compatible with CROMIX,™ CP/M2.2,™ MP/M,™ Alpha Micro, and other major systems.

4 PERSONALITY BOARDS.

☐ Centronics printer. ☐ 8 inch floppy disk. ☐ 5¼ inch floppy disk. ☐ RS232 serial communications. ☐ Synchronous/asynchronous modem. ☐ Priam smart/smart E hard disk. ☐ Long distance serial communication (2000 ft @ 9600 baud). ☐ Shugart Associates Systems Interface (SASI). ☐ Clock/calendar. ☐ Konan David,Jr.™ hard disk. ☐ Archive tape drive.



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